© THE QUEEN'S PRINTER FOR ONTARIO
2000

REPRODUCED WITH PERMISSION

---

L'IMPRIMEUR DE LA REINE POUR L'ONTARIO

REPRODUIT AVEC PERMISSION

micromedia
a division of IHS Canada

20 Victoria Street
Toronto, Ontario M5C 2N8
Tel.: (416) 362-5211
Toll Free: 1-800-387-2689
Fax: (416) 362-6161
Email: info@micromedia.on.ca

ONTARIO
CANADA
THE FUTURE'S RIGHT HERE

Ontario, a World Leader in Mining:
Explore the Opportunities

# Explore the opportunities in Ontario, Canada!

Where can you find outstanding mineral potential, a proven track record and an open business climate?

In Ontario – the dynamic global business centre that is the heart of Canada's buoyant and advanced economy.

WHAT'S HOT

Turn to page 20 for exploration recommendations from the Ontario Geological Survey for 2000.

WHAT'S NEW

"Operation Treasure Hunt," a two-year, $19 million program, will apply state-of-the-art geophysical and geochemical procedures to pinpoint new "buried or blind" mineral deposits in Ontario. The studies will uncover specific locations for prospectors and exploration companies to focus their activities in their search for new mines.

Survey areas and techniques are determined by the Ontario Ministry of Northern Development and Mines' Ontario Geological Survey (OGS) in cooperation with the Ontario Geological Survey Advisory Board (OGSAB). The advisory board, made up of industry-related experts, helps ensure that OGS mapping priorities reflect changing industry and scientific requirements.

## Ontario is excited about its mineral future. The province provides the investor with important advantages:

Varied and favourable geology with large regions of high mineral potential;

Mining laws that ensure secure land tenure and mine rehabilitation;

A world-class geoscience data infrastructure to help exploration companies and individuals identify significant exploration opportunities in the province;

Superior transportation and communications facilities, and a highly developed mining service and support industry;

A skilled workforce and some of the world's foremost authorities on geology and minerals;

Accessible capital markets in Toronto, the mine-financing capital of the world;

Stable government that provides an internationally competitive, export-oriented business climate with attractive tax incentives;

Low inflation, low interest rates, reduced public deficits and competitive business costs; and

A streamlined process for obtaining mineral development permits and a province-wide network of expert government staff.

# Contents


2 A proven mineral producer

4 Ontario's mining operations in 1999

8 Ontario's mining laws provide stable land tenure

10 Ontario encourages investment

11 Tax incentives

12 Accessible capital markets

13 "One-window" permits and expert consultants

14 Fast, easy access to information

15 Competitive costs, people and infrastructure

16 Ontario's geology and mineral deposits

19 What's happening in exploration and development

20 Exploration recommendations for 2000

23 International suppliers of mining equipment and services

24 Contacts

M121

IMPORTANT NOTE CONCERNING THE FOLLOWING PAGES

THE PAGES WHICH FOLLOW HAVE BEEN FILMED TWICE IN ORDER TO OBTAIN THE BEST REPRODUCTIVE QUALITY

USERS SHOULD CONSULT ALL THE PAGES REPRODUCED ON THE FICHE IN ORDER TO OBTAIN A COMPLETE READING OF THE TEXT.

---

REMARQUE IMPORTANTE CONCERNANT LES PAGES QUI SUIVENT

LES PAGES SUIVANTES ONT ÉTÉ REPRODUITES EN DOUBLE AFIN D'AMÉLIORER LA QUALITÉ DE REPRODUCTION

LES UTILISATEURS DOIVENT CONSULTER TOUTES LES PAGES REPRODUITES SUR LA FICHE AFIN D'OBTENIR LA LECTURE DU TEXTE INTÉGRAL

micromedia
a division of IHS Canada

20 Victoria Street
Toronto, Ontario M5C 2N8
Tel.: (416) 362-5211
Toll Free: 1-800-387-2689
Fax: (416) 362-6161
Email: info@micromedia.on.ca

# A proven mineral producer

Ontario has been one of the world's leading mineral producers for more than a century. Today it produces over $5 billion* worth of minerals a year, from barite to zinc.

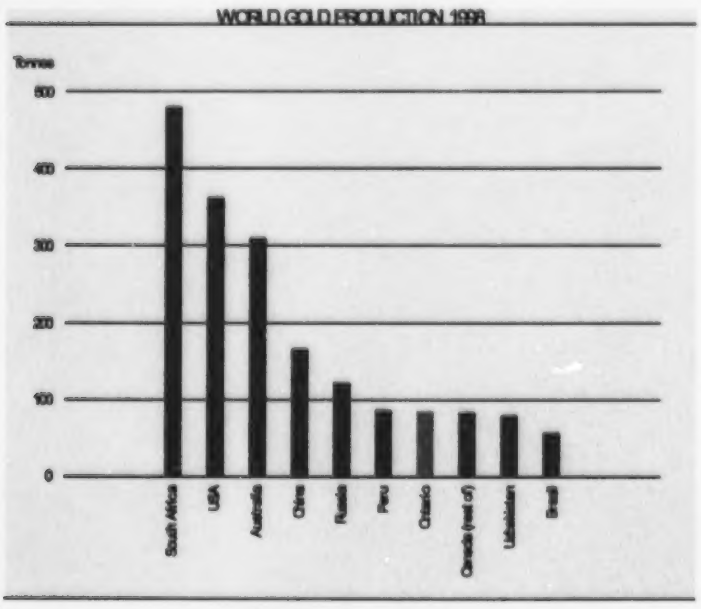
Ontario is Canada's largest producer of metallic minerals. Over the last century, Ontario has produced:

- over 158 million ounces of gold,
- over 1 billion ounces of silver,
- nearly 9.5 million tonnes of nickel,
- over 13 million tonnes of copper, and
- over 9 million tonnes of zinc.

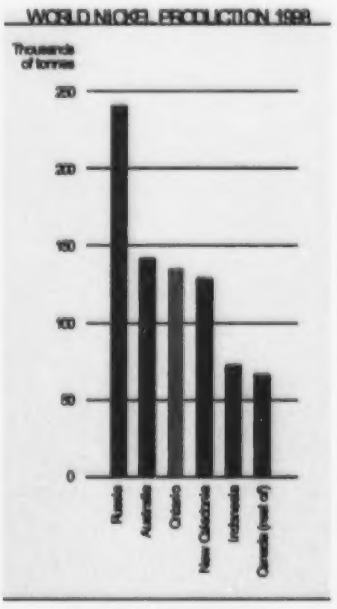
As well as metals, a wide variety of industrial minerals are successfully mined in the province. They include silica, talc, gypsum, salt and nepheline syenite.

Ontario is also a major producer of cement, stone, sand and gravel. The province's granite, marble and limestone grace buildings around the world.

- Ontario's Sudbury Basin produces about 13 per cent of the world's nickel.
- Ontario is Canada's leading source of gold. The three Hemlo area mines alone account for over one per cent of world production.
- In 1998, Ontario produced more than one-third of the copper mined in Canada.
- Canada is the world's leading zinc producer and exporter, and Ontario produces 10 per cent of Canada's zinc.
- Ontario produces nearly 80 per cent of Canada's cobalt as a byproduct of nickel-copper mining.
- In 1998, more than 143 million tonnes of structural materials were extracted in Ontario, including limestone, dolostone, shale, sand and gravel.
- Ontario's building stone industry produced more than 45 million tonnes of granite, marble and limestone in 1998.




Source: Natural Resources Canada




Source: Natural Resources Canada

*Unless otherwise indicated, all figures are in Canadian dollars.

# ...With vast mineral potential

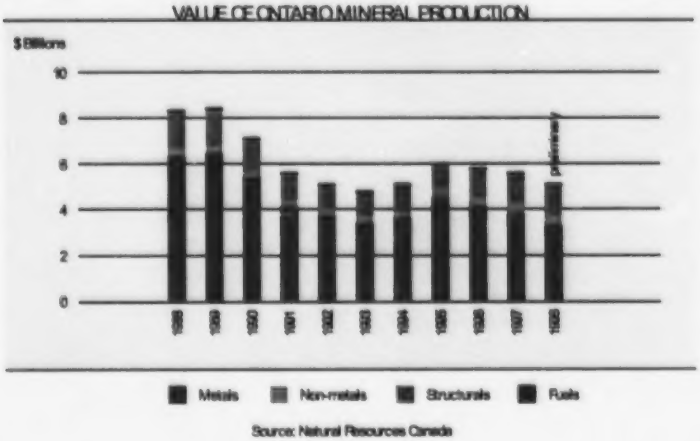
Ontario has a varied and favourable geology with large regions of high mineral potential.

Ontario covers more than one million square kilometres. Sixty per cent of its bedrock is Precambrian Shield, the source of most of Ontario's metals and some industrial minerals and building stone. Younger sedimentary rocks, which underlie the rest of the province, also host industrial minerals and building stone.

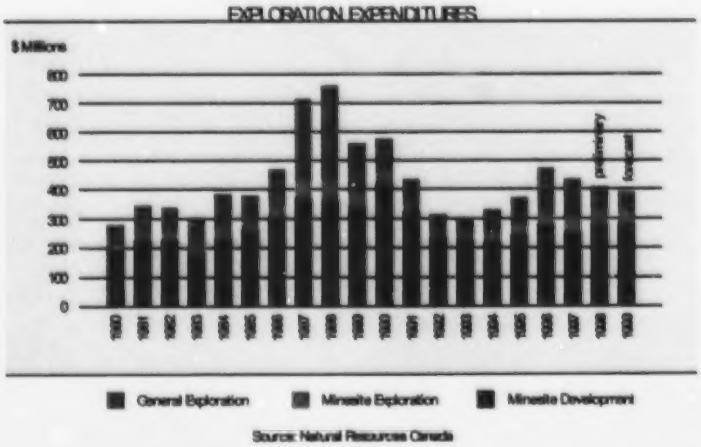
## Today Ontario's world ranking in metal production is

- third for nickel
- third for cobalt
- seventh for gold
- twelfth for copper
- fifteenth for silver
- seventeenth for zinc

Explorers continue to identify new mineral deposits and find additional ore at existing mines. In 1998, mining companies spent more than $400 million in Ontario on exploration and development. Gold, platinum group elements and base metals are the major exploration targets. Companies are increasingly interested in diamond and intrusive-hosted rare metal exploration targets. Industrial minerals, including granite, marble and limestone, are also showing great potential for growth.




Source: Natural Resources Canada




Source: Natural Resources Canada

# A proven mineral producer

Ontario has been one of the world's leading mineral producers for more than a century. Today it produces over $5 billion* worth of minerals a year, from barite to zinc.

Ontario is Canada's largest producer of metallic minerals. Over the last century, Ontario has produced:

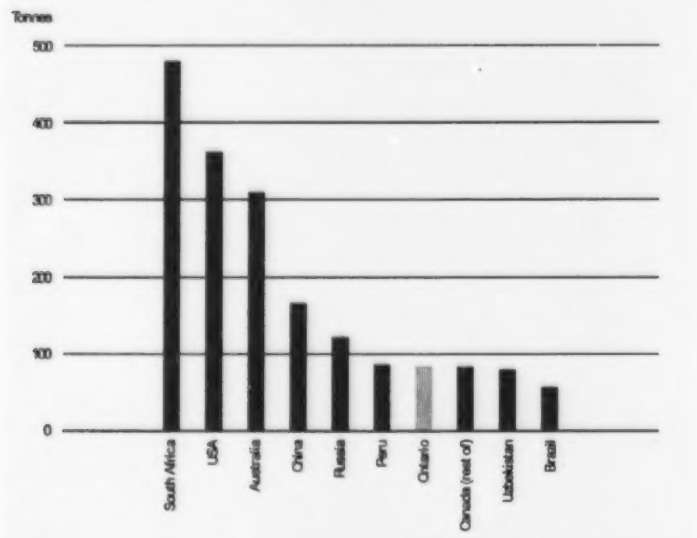
- over 158 million ounces of gold,
- over 1 billion ounces of silver,
- nearly 9.5 million tonnes of nickel,
- over 13 million tonnes of copper, and
- over 9 million tonnes of zinc.

As well as metals, a wide variety of industrial minerals are successfully mined in the province. They include silica, talc, gypsum, salt and nepheline syenite.

Ontario is also a major producer of cement, stone, sand and gravel. The province's granite, marble and limestone grace buildings around the world.

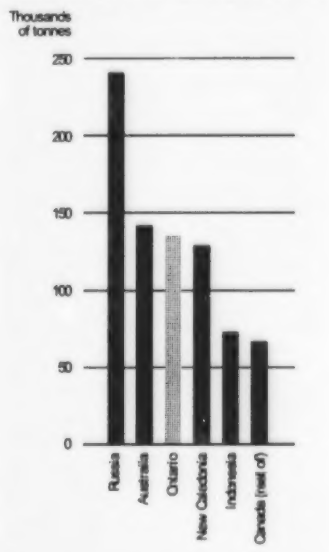
- Ontario's Sudbury Basin produces about 13 per cent of the world's nickel.
- Ontario is Canada's leading source of gold. The three Hemlo area mines alone account for over one per cent of world production.
- In 1998, Ontario produced more than one-third of the copper mined in Canada.
- Canada is the world's leading zinc producer and exporter, and Ontario produces 10 per cent of Canada's zinc.
- Ontario produces nearly 80 per cent of Canada's cobalt as a byproduct of nickel-copper mining.
- In 1998, more than 143 million tonnes of structural materials were extracted in Ontario, including limestone, dolostone, shale, sand and gravel.
- Ontario's building stone industry produced more than 45 million tonnes of granite, marble and limestone in 1998.

WORLD GOLD PRODUCTION 1998




Source: Natural Resources Canada

WORLD NICKEL PRODUCTION 1998




Source: Natural Resources Canada

*Unless otherwise indicated, all figures are in Canadian dollars.

# ...With vast mineral potential

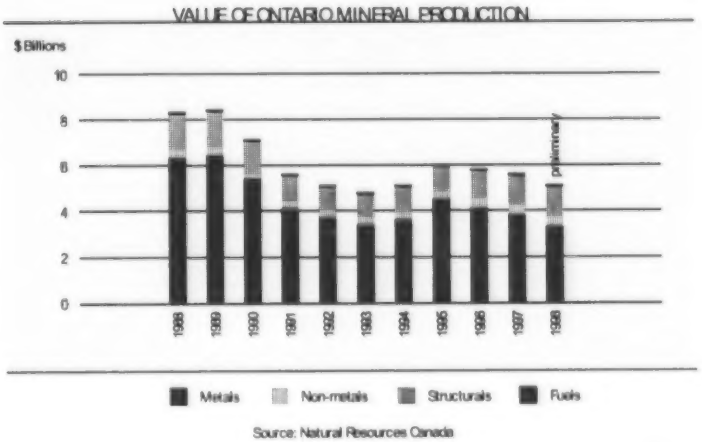
Ontario has a varied and favourable geology with large regions of high mineral potential.

Ontario covers more than one million square kilometres. Sixty per cent of its bedrock is Precambrian Shield, the source of most of Ontario's metals and some industrial minerals and building stone. Younger sedimentary rocks, which underlie the rest of the province, also host industrial minerals and building stone.

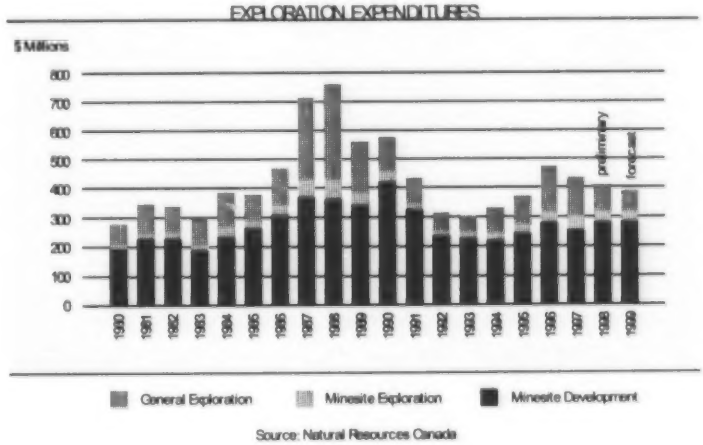
## Today Ontario's world ranking in metal production is:

- third for nickel
- third for cobalt
- seventh for gold
- twelfth for copper
- fifteenth for silver
- seventeenth for zinc

Explorers continue to identify new mineral deposits and find additional ore at existing mines. In 1998, mining companies spent more than $400 million in Ontario on exploration and development. Gold, platinum group elements and base metals are the major exploration targets. Companies are increasingly interested in diamond and intrusive-hosted rare metal exploration targets. Industrial minerals, including granite, marble and limestone, are also showing great potential for growth.




Source: Natural Resources Canada

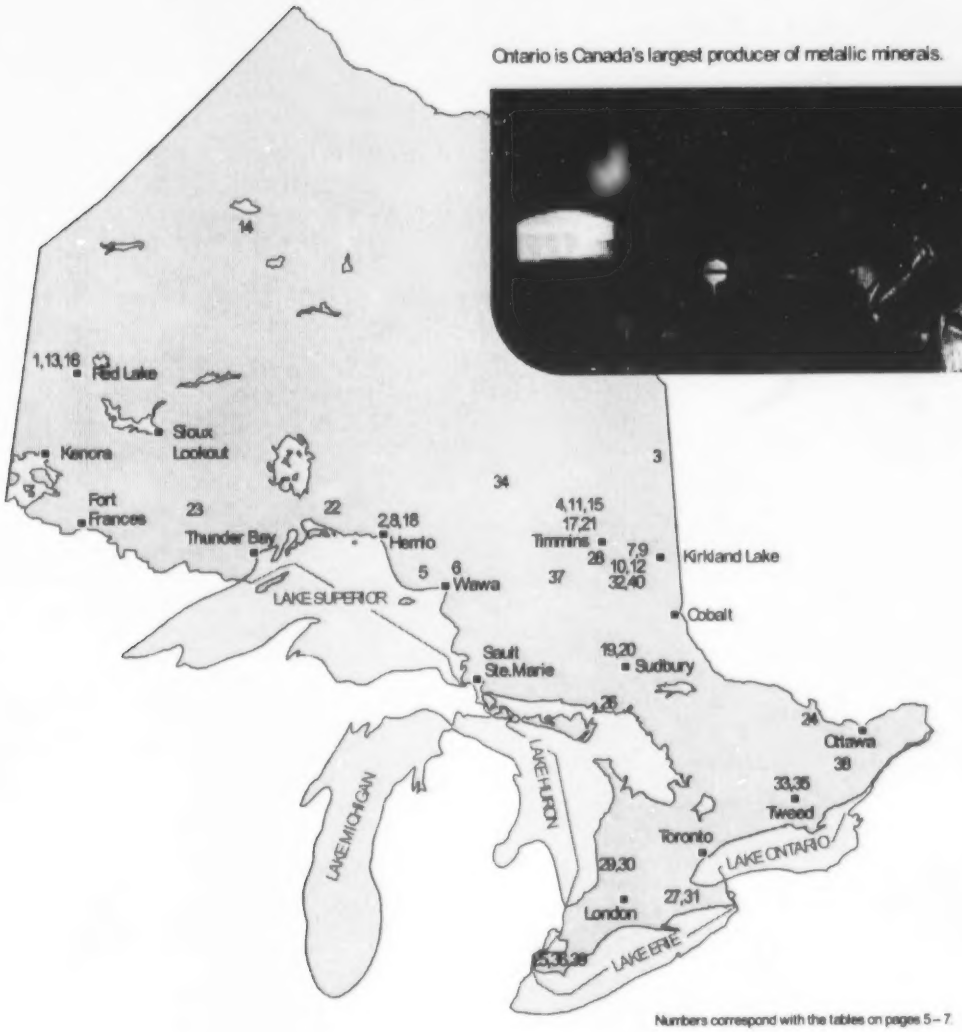



Source: Natural Resources Canada

100-06298/

# Ontario's mining operations in 1999

Ontario is Canada's largest producer of metallic minerals.




## EXPLORATION AND DEVELOPMENT HIGHLIGHTS

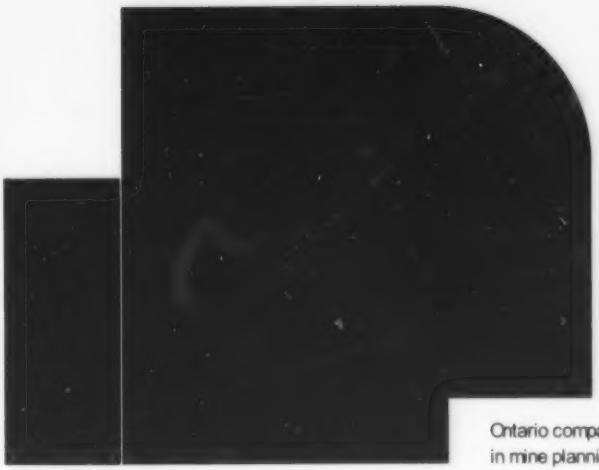
### NEW MINES

Agrium Incorporated has developed a new $100-million open-pit mine and mill at their Kapuskasing phosphate deposit located 30 kilometres southwest of Kapuskasing.

Belican Holdings Limited developed a new silica deposit in Rear of Leeds and Lansdowne Township. The company mines sandstone of the Potsdam Formation as a source of raw material for the glass industry.

In 1999, St. Andrew Goldfields Limited carried out two phases of diamond drilling on the West Area of the Hislop Mine property, east of Matheson. At least three gold mineralized zones have been defined which are amenable to open-pit mining. Ore reserves at a 1.7 grams per tonne cut off (0.05 opt) are 325,000 tonnes grading 3.4 grams per tonne (357,500 tons grading 0.10 opt).

Production figures are extracted directly from corporate reports. In some cases, a conversion to metric has been provided to assist the reader.



Ontario companies use state-of-the-art technology in mine planning and development.

GOLD MINES Refer to map on page 4

| | Name | Company | 1998 Production |
|---|---|---|---|
| 1 | Campbell | Placer Dome Canada Ltd. | 304,161 ounces |
| 2 | David Bell | Teck Corona Operating Corp. | 159,671 ounces |
| 3 | Detour Lake | Placer Dome Inc. | 140,530 ounces |
| 4 | Dome | Placer Dome Inc. | 328,939 ounces |
| 5 | Eagle River | River Gold Mines Ltd. | 75,629 ounces |
| 6 | Edwards | River Gold Mines Ltd. | 12,851 ounces (Nov–Dec) |
| 7 | Glimmer | Exall Resources Ltd. | Opened in 1998 |
| 8 | Golden Giant | Battle Mountain Canada | 369,600 ounces |
| 9 | Holloway Mine | Battle Mountain Canada | 97,101 ounces |
| 10 | Holt-McDermott | Barrick Gold Corp. | 134,379 ounces |
| 11 | Hoyle Pond Mine | Kinross Gold Corp. | 158,953 ounces |
| 12 | Macassa Division Mine and Lakeshore Tailings Project | Kinross Gold Corp. | 77,872 ounces |
| 13 | Madsen | Claude Resources Inc. | 8,930 ounces |
| 14 | Musselwhite | Placer Dome Canada Inc. | 199,682 ounces |
| 15 | Nighthawk | Royal Oak Mines Inc. | 31,736 ounces |
| 16 | Red Lake | Goldcorp Inc. | Production suspended |
| 17 | Timmins Division – Hoyle & Pamour | Royal Oak Mines Inc. | 61,220 ounces |
| 18 | Williams | Williams Operating Corp. | 390,440 ounces |

## MINE EXPANSIONS

The Kidd Creek Mine, owned by Falconbridge Limited, is being evaluated for a major deepening project below the 6,800-foot level to the 9,800-foot level to access deep copper, zinc and silver mineralization. A feasibility study is underway, and if successful, the project will extend the current mine life to 2015.

Placer Dome Inc. continued gold production at its Campbell Mine in Balmertown. The Reid shaft, collared in 1995 and designed to reach a depth of 1,820 metres to access deeper ore zones, was commissioned in 1999.

In late 1999, Brampton Brick Limited began a $30–33 million expansion of their Brampton plant that will increase capacity by 50 per cent to about 200 million brick units per year. The increased brick production will result in accelerated mining of shale from the company's Cheltenham Quarry in 2000.

BASE METAL MINES Refer to map on page 4

| | Name | Company | 1998 Production |
|---|---|---|---|
| 19 | Falconbridge<br>Sudbury Operations:<br>Fraser<br>Lockerby<br>Onaping-Craig<br>Strathcona<br>Thayer Lindsley | Falconbridge Ltd. | 41,670 tonnes nickel<br>51,780 tonnes copper<br>cobalt<br>sulphuric acid<br>precious metals |
| 20 | Inco Sudbury<br>Operations:<br>Copper Cliff North<br>Copper Cliff South<br>Crean Hill<br>Creighton<br>Frood<br>Garson<br>Little Stobie<br>Lower Coleman<br>McCreedy East<br>McCreedy West<br>Stobie<br>Whistle | Inco Limited | 141,450 tonnes nickel<br>131,650 tonnes copper<br>cobalt<br>platinum group metals<br>sulphuric acid<br>liquid sulphuric dioxide |
| 21 | Kidd Creek | Falconbridge Ltd. | 2.55 million tonnes @<br>2.78% copper,<br>5.01% zinc,<br>0.18% lead and<br>66 grams per tonne silver |
| 22 | Winston Lake | Inmet Mining Corp. | 129,143 tonnes milled @<br>0.59% copper and<br>8.48% zinc |

Ontario has been one of the world's leading mineral producers for more than a century.

## EXPLORATION AND DEVELOPMENT HIGHLIGHTS

### MINE EXPANSIONS

OMYA Canada Incorporated has completed the fourth year of a five-year plant expansion program near Perth. The company produces a variety of calcium carbonate products from a calcitic marble extracted from the nearby Tatlock Quarry in Darling Township. Annual production is 250,000 tons (226,796 tonnes) with reserves of more than five million tons (4.54 million tonnes).

Battle Mountain Gold and Teddy Bear Valley Mines Limited — Capital expenditures on the Holloway Mine property for 1999 amounted to $6.2 million. The companies plan to spend more than $1.8 million on underground exploration and $400,000 on surface exploration near the mine property.

Barrick Gold Corporation announced that the Holt-McDermott Mine shaft will be deepened from 941 metres to 1,196 metres with production levels established at 925- and 1075-metre levels. The project will take three years to complete at a capital cost of $18 million.

## OTHER METAL MINES Refer to map on page 4

| | Name | Company | 1998 Production |
|---|---|---|---|
| 23 | Lac des Iles | Lac des Iles Mines Ltd. | 50,000 ounces palladium<br>4,000 ounces platinum<br>3,600 ounces gold<br>450 tonnes copper<br>350 tonnes nickel<br>(estimated) |
| 24 | Timminco Metals | Timminco Ltd. | 6,000 tonnes magnesium<br>400 tonnes calcium<br>135 tonnes strontium |

## MAJOR INDUSTRIAL MINERAL OPERATIONS Refer to map on page 4

| | Name | Company | 1998 Production |
|---|---|---|---|
| 25 | Anderdon Brine Field | General Chemical Canada Ltd. | 850,000 tonnes salt |
| 26 | Badgley Island | Unimin Canada Ltd. | 390,089 tonnes silica |
| 27 | Caledonia No.3 | Georgia Pacific Canada Ltd. | 450,000 tonnes gypsum |
| 28 | Fripp Township | Great White Minerals | 45,359 tonnes silica |
| 29 | Goderich Brine Field | Sifto Canada Inc. | 120,000 tonnes salt in brine |
| 30 | Goderich | Sifto Canada Inc. | 6 million tonnes salt |
| 31 | Hagersville | Canadian Gypsum Canada Ltd. | 680,000 tonnes gypsum |
| 32 | Hedman | Hedman Resources Ltd. | 1,270 tonnes lizardite |
| 33 | Henderson | Canada Talc, a Division of Highwood Resources | 7,500 tonnes talcose (1999) |
| 34 | Kapuskasing Phosphate Operation | Agrium Inc. | Production commenced in 1999 |
| 35 | Nepheline Syenite Operations | Unimin Canada Ltd. | Capacity — 2,500 tonnes per day nepheline syenite |
| 36 | Ojibway | The Canadian Salt Co. Ltd. | 2.5 million tonnes salt |
| 37 | Penhorwood | Luzenac Inc. | 34,019 tonnes talc |
| 38 | Tatlock Quarry | OMYA Canada Inc. | 226,796 tonnes calcite |
| 39 | Windsor Brine Field | The Canadian Salt Co. Ltd. | 180,000 tonnes salt in brine |
| 40 | Yarrow Township | Extender Minerals of Canada Ltd. | 1,360 tonnes barite |

## MINE DEVELOPMENT

Goldcorp Incorporated continued underground exploration at their Red Lake Mine. New gold-bearing zones were delineated by underground diamond drilling. High-grade zone reserves are calculated at 1.89 million ounces contained in 1.39 million tons (1.26 million tonnes) with an average diluted cut grade of 1.36 ounces per ton. Goldcorp's exploration budget for 1999 was $8 million.

North American Palladium Limited has increased its reserves at the Lac des Iles Mine to 94.1 million tonnes grading 1.66 grams per tonne palladium, 0.18 grams per tonne platinum, 0.14 grams per tonne gold, 0.062% copper and 0.053% nickel. The company received a positive detailed feasibility study on a proposed expansion of the operation to 15,000 tonnes per day from the current 2,400 tonnes per day.

Falconbridge Limited continued development of its Thayer Lindsley Mine, shifting from a high-grade, low-tonnage nickel-copper operation to a low-grade, high-tonnage operation. This has increased mineable reserves to five million tonnes.

M121

IMPORTANT NOTE CONCERNING THE FOLLOWING PAGES

THE PAGES WHICH FOLLOW HAVE BEEN FILMED TWICE IN ORDER TO OBTAIN THE BEST REPRODUCTIVE QUALITY

USERS SHOULD CONSULT ALL THE PAGES REPRODUCED ON THE FICHE IN ORDER TO OBTAIN A COMPLETE READING OF THE TEXT.

---

REMARQUE IMPORTANTE CONCERNANT LES PAGES QUI SUIVENT

LES PAGES SUIVANTES ONT ÉTÉ REPRODUITES EN DOUBLE AFIN D'AMÉLIORER LA QUALITÉ DE REPRODUCTION

LES UTILISATEURS DOIVENT CONSULTER TOUTES LES PAGES REPRODUITES SUR LA FICHE AFIN D'OBTENIR LA LECTURE DU TEXTE INTÉGRAL

micromedia
a division of IHS Canada

20 Victoria Street
Toronto, Ontario M5C 2N8
Tel.: (416) 362-5211
Toll Free: 1-800-387-2689
Fax: (416) 362-6161
Email: info@micromedia.on.ca

# Ontario's mining laws provide stable land tenure

Ontario's *Mining Act* provides a secure and stable basis for land tenure, mineral exploration and development.

Ontario's Ministry of Northern Development and Mines (MNDM) administers the *Mining Act*. The *Mining Act* sets out clear, fair rules for all aspects of mining.

## Acquiring Title

Companies acquire initial title to mineral rights through staking.

To guarantee security of tenure, no dispute over a claim is accepted after the claim has been on record for more than one year, or after the first year's assessment work has been performed and approved.

Mining claims in Ontario are obtained by on-site staking.

## Staking a Claim

Claims may be staked individually or or in a block of up to 16 single claim units. A single claim unit is 16 hectares (40 acres). A claim must be staked in accordance with the *Mining Act*.

Mining claim maps are available from the Provincial Recording Office (PRO) in the Mining Lands office in Sudbury or from the Ministry's Mining Lands web page (www.gov.on.ca/ MNDM/ MINES/ LANDS/ mlsmnpge.htm). The maps show all recorded claims and land open for staking.

Ontario requires prospectors to be licensed if they wish to stake and record a claim in the province. Applications for the five-year licences are available from the PRO and mining lands consultants in MNDM field offices. Licences cost $25 and may be purchased by applicants aged 18 or older, from any country.

Individuals or companies do not need a licence to hold a valid interest in a mining claim.

## EXPLORATION AND DEVELOPMENT HIGHLIGHTS

### MINE DEVELOPMENT

Inco Limited continued a US$125 million development project at its Creighton Mine. Six million tonnes of high-grade nickel-copper ore between the 7,400-foot and 7,699-foot levels will be brought into production in 2001. The project should continue until 2013.

Highwood Resources acquired the Canada Talc property near Madoc in December 1998. During 1999, the company completed substantial upgrading to the plant and milling facilities. Development of recently identified talc reserves at the minesite is scheduled. The company also has expressed a strong interest in investigating other industrial mineral deposits in southeastern Ontario.

### ADVANCED EXPLORATION

Canmine Resources Corporation has reached an agreement to acquire a hydrometallurgical cobalt extraction plant and refinery, formerly owned by Cobatec Inc., for $6.1 million. This facility, located in Cobalt, will enable Canmine to upgrade cobalt concentration from the company's Werner Lake cobalt project into cobalt carbonate.

Ontario has a strong infrastructure of mills, smelters and refineries for processing precious and base metals.

## Keeping a Claim in Good Standing

No annual fees are required to keep a claim in good standing. Starting in the second year after a claim is recorded, however, at least $400 of assessment work per claim must be carried out and reported each year.

A wide range of mineral exploration and development activities qualify as assessment work. Details are available through the PRO or mining land consultants.

## Going into Production

Ontario requires a lease for production from a mining property. Leases last 21 years and are renewable.

A claim holder has the right to convert a claim to a lease at any time after the first unit of assessment work has been completed and approved, and the other requirements of the *Mining Act* have been met.

A lease is not required unless production is planned. A claim can be maintained indefinitely by completing the required amount of assessment work each year.

## Planning for Closure

Companies must file closure plans for mining operations and advanced exploration projects, and must provide financial assurance that the plans will be carried out. This requirement ensures that companies develop Ontario's mineral wealth in a responsible and environmentally sustainable manner.

Pele Mountain Resources Incorporated has tested a 10,000-ton (9,072-tonne) bulk sample of gold-bearing ore from their Jacobson Township property near Wawa. The average grade of the bulk sample was approximately five grams per tonne gold.

River Gold Mines Limited extracted a bulk sample of approximately 86,000 tonnes from the Vega Property in Riggs Township in December 1999. Should the reserves at both the Vega deposit and Pele Mountain's Markes deposit prove to be economic, both pits will be mined and the ore will be processed at River Gold's Magnacon Mill.

Exploration at Placer Dome's Musselwhite Mine has continued via surface and underground drilling which is expected to outline an additional 500,000 ounces of gold in reserves. Over the past year, some 60,000 metres have been drilled. The program was completed in mid-December 1999.

# Ontario's mining laws provide stable land tenure

Ontario's *Mining Act* provides a secure and stable basis for land tenure, mineral exploration and development.

Ontario's Ministry of Northern Development and Mines (MNDM) administers the *Mining Act*. The *Mining Act* sets out clear, fair rules for all aspects of mining.

Mining claims in Ontario are obtained by on-site staking.

## Acquiring Title

Companies acquire initial title to mineral rights through staking.

To guarantee security of tenure, no dispute over a claim is accepted after the claim has been on record for more than one year, or after the first year's assessment work has been performed and approved.

## Staking a Claim

Claims may be staked individually or or in a block of up to 16 single claim units. A single claim unit is 16 hectares (40 acres). A claim must be staked in accordance with the *Mining Act*.

Mining claim maps are available from the Provincial Recording Office (PRO) in the Mining Lands office in Sudbury or from the Ministry's Mining Lands web page (www.gov.on.ca/ MNDM/ MINES/ LANDS/ mlsmnpge.htm). The maps show all recorded claims and land open for staking.

Ontario requires prospectors to be licensed if they wish to stake and record a claim in the province. Applications for the five-year licences are available from the PRO and mining lands consultants in MNDM field offices. Licences cost $25 and may be purchased by applicants aged 18 or older, from any country.

Individuals or companies do not need a licence to hold a valid interest in a mining claim.

## EXPLORATION AND DEVELOPMENT HIGHLIGHTS

### MINE DEVELOPMENT

Inco Limited continued a US$125 million development project at its Creighton Mine. Six million tonnes of high-grade nickel-copper ore between the 7,400-foot and 7,699-foot levels will be brought into production in 2001. The project should continue until 2013.

Highwood Resources acquired the Canada Talc property near Madoc in December 1998. During 1999, the company completed substantial upgrading to the plant and milling facilities. Development of recently identified talc reserves at the minesite is scheduled. The company also has expressed a strong interest in investigating other industrial mineral deposits in southeastern Ontario.

### ADVANCED EXPLORATION

Canmine Resources Corporation has reached an agreement to acquire a hydrometallurgical cobalt extraction plant and refinery, formerly owned by Cobatec Inc., for $8.1 million. This facility, located in Cobalt, will enable Canmine to upgrade cobalt concentration from the company's Werner Lake cobalt project into cobalt carbonate.

Ontario has a strong infrastructure of mills, smelters and refineries for processing precious and base metals.

## Keeping a Claim in Good Standing

No annual fees are required to keep a claim in good standing. Starting in the second year after a claim is recorded, however, at least $400 of assessment work per claim must be carried out and reported each year.

A wide range of mineral exploration and development activities qualify as assessment work. Details are available through the PRO or mining land consultants.

## Going into Production

Ontario requires a lease for production from a mining property. Leases last 21 years and are renewable.

A claim holder has the right to convert a claim to a lease at any time after the first unit of assessment work has been completed and approved, and the other requirements of the *Mining Act* have been met.

A lease is not required unless production is planned. A claim can be maintained indefinitely by completing the required amount of assessment work each year.

## Planning for Closure

Companies must file closure plans for mining operations and advanced exploration projects, and must provide financial assurance that the plans will be carried out. This requirement ensures that companies develop Ontario's mineral wealth in a responsible and environmentally sustainable manner.

---

Pele Mountain Resources Incorporated has tested a 10,000-ton (9,072-tonne) bulk sample of gold-bearing ore from their Jacobson Township property near Wawa. The average grade of the bulk sample was approximately five grams per tonne gold.

River Gold Mines Limited extracted a bulk sample of approximately 86,000 tonnes from the Vega Property in Riggs Township in December 1999. Should the reserves at both the Vega deposit and Pele Mountain's Markes deposit prove to be economic, both pits will be mined and the ore will be processed at River Gold's Magnacon Mill.

Exploration at Placer Dome's Musselwhite Mine has continued via surface and underground drilling which is expected to outline an additional 500,000 ounces of gold in reserves. Over the past year, some 60,000 metres have been drilled. The program was completed in mid-December 1999.

# Ontario encourages investment

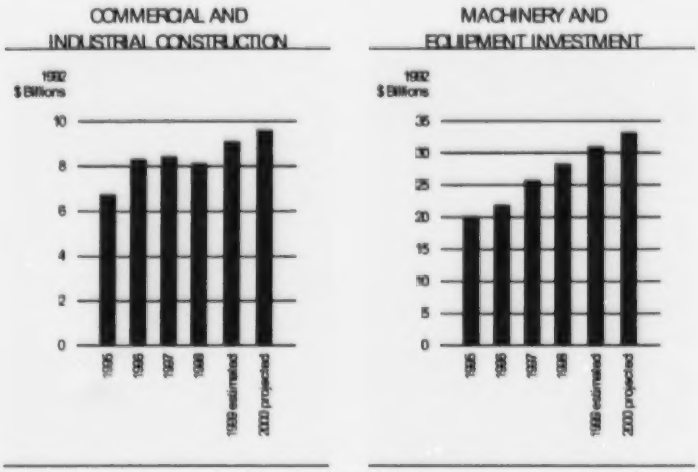
The Government of Ontario has taken important measures to ensure the province's business climate is internationally competitive and export-oriented.

It has moved boldly to initiate 99 tax cuts. It has eliminated more than 1,300 unnecessary regulations. It has restructured the publicly funded health care, education, social assistance and municipal systems and, at the end of 1999, was on track to balance the budget in 2000–2001.

The government has also boosted education and skills, spurred innovation and research and development, and committed to major reinvestment in the provincial infrastructure, including $936 million for the provincial highways system in 1999–2000 alone.

The results? Ontario is leading Canada in economic growth and gaining recognition from investors around the world as an excellent place to do business. Ontario is a preferred location with an open economy and attractive incentives that encourage investment in exploration, development and the production of mineral resources.

PROJECTED ONTARIO INVESTMENT, 1999–2000




Sources: Statistics Canada, Ontario Ministry of Finance

## EXPLORATION AND DEVELOPMENT HIGHLIGHTS

### ADVANCED EXPLORATION

Wolfden Resources plans to perform bulk sampling soon on the crown pillar of the past-producing Pickle Crow Mine. They are presently completing a surface diamond drilling program on the property and have reportedly discovered a new mineralized zone.

In April 1998, Madsen Gold Corp. was taken over by Claude Resources Incorporated and preproduction work continued until November 1999 in both the original Madsen Mine and advanced exploration on the adjacent McVeigh zone. In September 1999 the company announced a $10-million diamond drilling program at the mine on the McVeigh zone and the upper levels of the original mine plus a program to identify high-grade reserves at depth from the mafic/ultramafic No. 8 zone.

# Tax incentives

Ontario taxes the profits generated from mining operations, a system that is considered fairer to the industry than royalties. Profits from downstream processing are excluded from mining tax.

The Government of Ontario offers generous tax incentives to mining operations. The Government of Canada also offers incentives to the mining industry for exploration and development, and research and development, as well as resource allowances. The Canadian and Ontario governments allow the deduction of contributions to mine reclamation funds.

ONTARIO MINING TAX INCENTIVES

| | |
|---|---|
| Deduction of exploration and development expenses | 100 per cent |
| Tax holiday for new or expanded mines | 3 years |
| Deduction of research and development expenses | 100 per cent |
| Depreciation of mining assets | Up to 100 per cent |
| Exemption of processing profits | Annual graduated processing allowances of 8 to 20 per cent of capital investment in processing |
| Tax exemption from aggregated mining profits | $500,000 annually |
| Tax rate on mining profits | Flat 20 per cent rate on profits over $500,000 |
| Corporate income tax rate | 13.5 per cent |

Ontario ranks seventh in the world in gold production.

Falconbridge Limited continues to outline newly discovered orebodies at the Chaping Deep, Craig Deep, and Southeast zones, all of which are in the north range of the Sudbury Igneous Complex. Work also continued on the Norman West zone on the east range of the Sudbury structure.

Avalon Ventures Limited updated a prefeasibility study of its Big Whopper petalite (lithium silicate) deposit north of Kenora. The company expects that market demand for its petalite can be met by processing less ore and that all of the petalite produced can be marketed as a high-grade product averaging 4.41 per cent dilithium oxide with a low iron content. Avalon proposes annual petalite production beginning at 17,000 tonnes and increasing to more than 32,000 tonnes in the fifth year.

# Ontario encourages investment

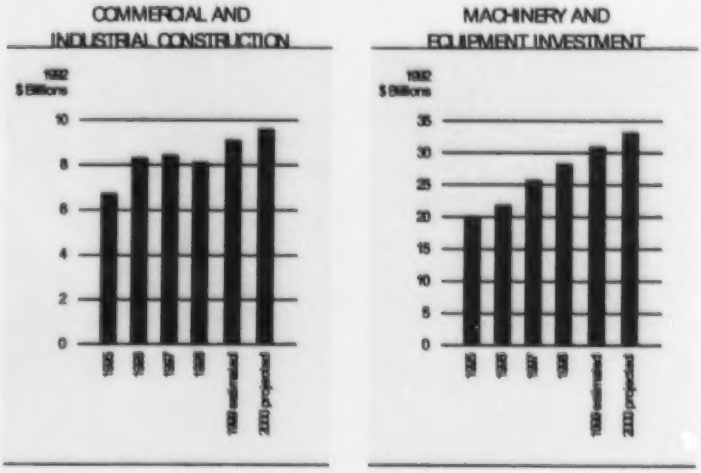
The Government of Ontario has taken important measures to ensure the province's business climate is internationally competitive and export-oriented.

It has moved boldly to initiate 99 tax cuts. It has eliminated more than 1,300 unnecessary regulations. It has restructured the publicly funded health care, education, social assistance and municipal systems and, at the end of 1999, was on track to balance the budget in 2000–2001.

The government has also boosted education and skills, spurred innovation and research and development, and committed to major reinvestment in the provincial infrastructure, including $936 million for the provincial highways system in 1999–2000 alone.

The results? Ontario is leading Canada in economic growth and gaining recognition from investors around the world as an excellent place to do business. Ontario is a preferred location with an open economy and attractive incentives that encourage investment in exploration, development and the production of mineral resources.

PROJECTED ONTARIO INVESTMENT, 1999–2000




Sources: Statistics Canada; Ontario Ministry of Finance

## EXPLORATION AND DEVELOPMENT HIGHLIGHTS

### ADVANCED EXPLORATION

Wolfden Resources plans to perform bulk sampling soon on the crown pillar of the past-producing Pickle Crow Mine. They are presently completing a surface diamond drilling program on the property and have reportedly discovered a new mineralized zone.

In April 1998, Madsen Gold Corp. was taken over by Claude Resources Incorporated and preproduction work continued until November 1999 in both the original Madsen Mine and advanced exploration on the adjacent McVeigh zone. In September 1999 the company announced a $10-million diamond drilling program at the mine on the McVeigh zone and the upper levels of the original mine plus a program to identify high-grade reserves at depth from the mafic/ultramafic No. 8 zone.

# Tax incentives

Ontario taxes the profits generated from mining operations, a system that is considered fairer to the industry than royalties. Profits from downstream processing are excluded from mining tax.

The Government of Ontario offers generous tax incentives to mining operations. The Government of Canada also offers incentives to the mining industry for exploration and development, and research and development, as well as resource allowances. The Canadian and Ontario governments allow the deduction of contributions to mine reclamation funds.

ONTARIO MINING TAX INCENTIVES

| | |
|---|---|
| Deduction of exploration and development expenses | 100 per cent |
| Tax holiday for new or expanded mines | 3 years |
| Deduction of research and development expenses | 100 per cent |
| Depreciation of mining assets | Up to 100 per cent |
| Exemption of processing profits | Annual graduated processing allowances of 8 to 20 per cent of capital investment in processing |
| Tax exemption from aggregated mining profits | $500,000 annually |
| Tax rate on mining profits | Flat 20 per cent rate on profits over $500,000 |
| Corporate income tax rate | 13.5 per cent |

Ontario ranks seventh in the world in gold production.

Falconbridge Limited continues to outline newly discovered orebodies at the Chaping Deep, Craig Deep, and Southeast zones, all of which are in the north range of the Sudbury Igneous Complex. Work also continued on the Norman West zone on the east range of the Sudbury structure.

Avalon Ventures Limited updated a prefeasibility study of its Big Whopper petalite (lithium silicate) deposit north of Kenora. The company expects that market demand for its petalite can be met by processing less ore and that all of the petalite produced can be marketed as a high-grade product averaging 4.41 per cent dilithium oxide with a low iron content. Avalon proposes annual petalite production beginning at 17,000 tonnes and increasing to more than 32,000 tonnes in the fifth year.

# Accessible capital markets

Toronto, Ontario, is the mine-financing capital of the world. From 1996–1999, an average of $2.5 billion a year in new equity capital was raised for mining projects through Toronto's banks, brokerages and security dealers.

The Toronto Stock Exchange (TSE), the fourth largest stock exchange in North America, is a global leader in the mining industry. There were 280 mining companies with a market capitalization valued over $80 billion listed on the TSE in 1999.

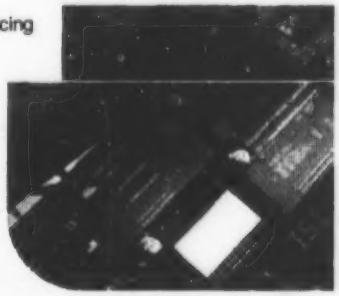
## Open to Foreign Investment

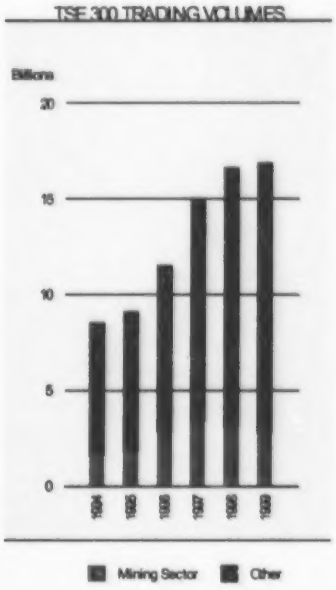
Foreign investors in Ontario enterprises are subject to the same taxes and laws as domestic investors. Tax treaties between Canada and many other countries avoid double taxation of corporate profits.

## Information Service for Investors

Ontario's Ministry of Northern Development and Mines (MNDM) provides investors with extensive and up-to-date information on mineral exploration and development. See page 24 for MNDM contacts or visit the Ministry's website (www.gov.on.ca/ MNDM).

Toronto is the mine financing capital of the world.






Source: TSE Market Data

## EXPLORATION AND DEVELOPMENT HIGHLIGHTS

### ADVANCED EXPLORATION

Regis Resources acquired the Goshawk property in 1997 and has outlined a new zone of vermiculite to the west of Highway 507 in Cavendish Township. In 1999, the company staked additional claims over adjacent areas thought to have high potential. Diamond drilling to confirm the depth extent of the weathered material was completed.

### MAJOR EXPLORATION PROJECTS

Franco-Nevada Mining Corporation Limited reported that previous surface diamond drilling on their Hemlo property adjacent to the Williams Mine defined an inferred resource of 1.75 million ounces of gold. In 1999, the company tested the upper portion of the Hemlo horizon across 765 metres of strike length on their property.

Kinross Gold Corporation and United Tex-Sol Mines Incorporated are exploring the Clavos gold deposit east of Timmins. A 20,000-metre diamond drill program is underway and has encountered encouraging gold mineralization.

# "One-window" permits and expert consultants

Ontario has a skilled workforce and some of the world's foremost authorities on geology and minerals.

Ontario provides a streamlined, "one-window" process for obtaining permits for mineral development.

The Ontario Ministry of Northern Development and Mines (MNDM) leads the process. Staff from MNDM coordinate communication among the mining industry, the public and provincial ministries and agencies. They give advice on legislation and guide companies through the permitting process.

To ensure maximum support from MNDM, companies should contact the Ministry early when planning an advanced exploration or new mining project. MNDM is widely recognized for its computerized claims system, consulting services, geological research, map production, and laboratory techniques. To contact MNDM Mineral Development consultants, see page 24.

Canabrava Diamond Corporation, Paramount Ventures and Rinance Incorporated and Kenecott Canada Exploration Incorporated have a major exploration program underway that extends from Wawa to Kapuskasing. The companies are searching for diamonds with a $25-million exploration budget.

Ontex Resources Limited initiated a major drill program and airborne geophysical program on the Brookbank and Cherbourg gold properties, Irwin Township (Beardmore area). The Brookbank Deposit contains an inferred mineral resource of 1.36 million tons (1.25 million tonnes) of ore grading 0.263 ounces per ton, as identified in previous drilling. The objective of the 1999 program was to expand the gold resource. Drill hole C-99-03 intersected 44.62 feet grading 0.121 ounces per ton. Drilling continues on the property.

# Accessible capital markets

Toronto, Ontario, is the mine-financing capital of the world. From 1996–1999, an average of $2.5 billion a year in new equity capital was raised for mining projects through Toronto's banks, brokerages and security dealers.

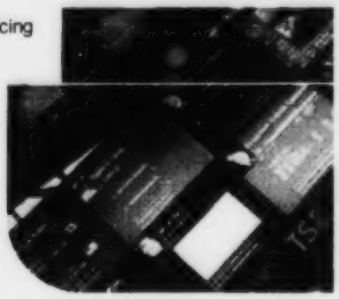
The Toronto Stock Exchange (TSE), the fourth largest stock exchange in North America, is a global leader in the mining industry. There were 280 mining companies with a market capitalization valued over $80 billion listed on the TSE in 1999.

## Open to Foreign Investment

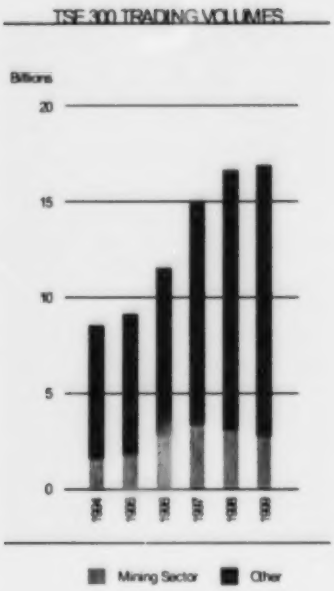
Foreign investors in Ontario enterprises are subject to the same taxes and laws as domestic investors. Tax treaties between Canada and many other countries avoid double taxation of corporate profits.

## Information Service for Investors

Ontario's Ministry of Northern Development and Mines (MNDM) provides investors with extensive and up-to-date information on mineral exploration and development. See page 24 for MNDM contacts or visit the Ministry's website (www.gov.on.ca/ MNDM).



Toronto is the mine financing capital of the world.




Source: TSE Market Data

## EXPLORATION AND DEVELOPMENT HIGHLIGHTS

### ADVANCED EXPLORATION

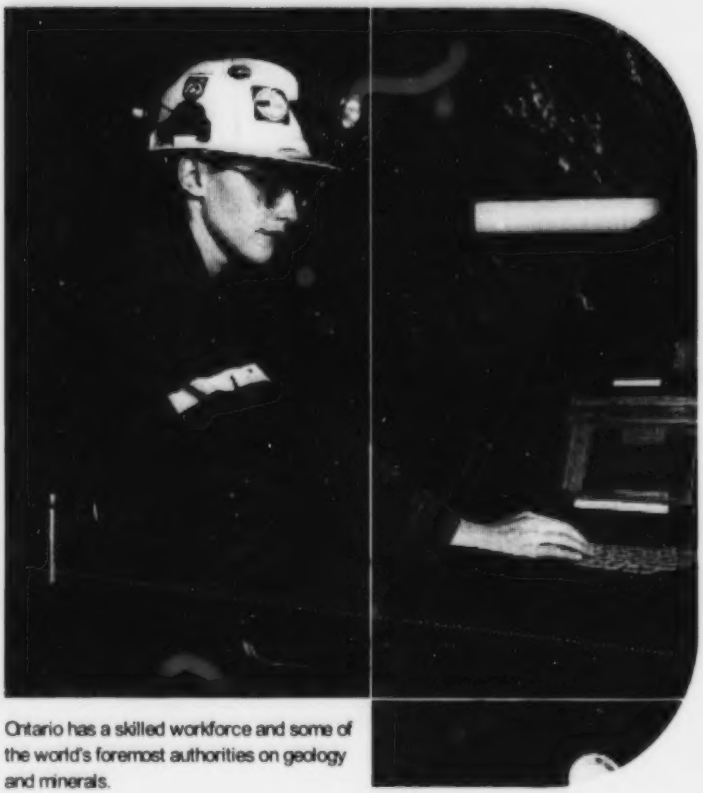
Regis Resources acquired the Goshawk property in 1997 and has outlined a new zone of vermiculite to the west of Highway 507 in Cavendish Township. In 1999, the company staked additional claims over adjacent areas thought to have high potential. Diamond drilling to confirm the depth extent of the weathered material was completed.

### MAJOR EXPLORATION PROJECTS

Franco-Nevada Mining Corporation Limited reported that previous surface diamond drilling on their Hemlo property adjacent to the Williams Mine defined an inferred resource of 1.75 million ounces of gold. In 1999, the company tested the upper portion of the Hemlo horizon across 765 metres of strike length on their property.

Kinross Gold Corporation and United Tex-Sol Mines Incorporated are exploring the Clavos gold deposit east of Timmins. A 20,000-metre diamond drill program is underway and has encountered encouraging gold mineralization.

# "One-window" permits and expert consultants



Ontario has a skilled workforce and some of the world's foremost authorities on geology and minerals.

Ontario provides a streamlined, "one-window" process for obtaining permits for mineral development.

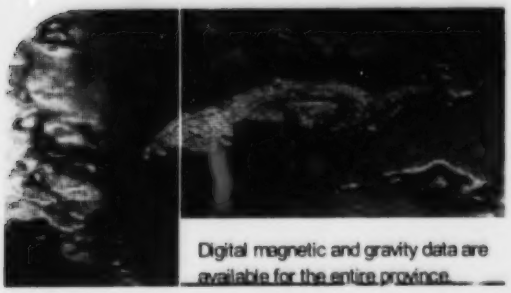
The Ontario Ministry of Northern Development and Mines (MNDM) leads the process. Staff from MNDM coordinate communication among the mining industry, the public and provincial ministries and agencies. They give advice on legislation and guide companies through the permitting process.

To ensure maximum support from MNDM, companies should contact the Ministry early when planning an advanced exploration or new mining project. MNDM is widely recognized for its computerized claims system, consulting services, geological research, map production, and laboratory techniques. To contact MNDM Mineral Development consultants, see page 24.

Canabrava Diamond Corporation, Paramount Ventures and Finance Incorporated and Kenecott Canada Exploration Incorporated have a major exploration program underway that extends from Wawa to Kapuskasing. The companies are searching for diamonds with a $25-million exploration budget.

Ontex Resources Limited initiated a major drill program and airborne geophysical program on the Brookbank and Cherbourg gold properties, Irwin Township (Beardmore area). The Brookbank Deposit contains an inferred mineral resource of 1.38 million tons (1.25 million tonnes) of ore grading 0.283 ounces per ton, as identified in previous drilling. The objective of the 1999 program was to expand the gold resource. Drill hole C-99-03 intersected 44.62 feet grading 0.121 ounces per ton. Drilling continues on the property.

# Fast, easy access to information



Digital magnetic and gravity data are available for the entire province.

The Ontario Ministry of Northern Development and Mines (MNDM) provides the information that companies and investors need on Ontario's mineral deposits, geology, exploration assessment work, and geochemical and geophysical projects.

MNDM's Mines Library, Ontario Geological Survey offices, Mining Lands offices, and Mines and Minerals Information Centre house nearly 400,000 reports, maps and records.

The Earth Resources and Land Information System (ERLIS) allows fast, easy access to most of the Ministry's information at MNDM offices across Ontario. ERLIS contains over 1.5 million pages of documents and approximately 120,000 maps. Computer workstations provide fast retrieval and high visual resolution. ERLIS thematic data sets include:

- topographic bases at various scales for reference to other subjects of digital data,
- digital bedrock geology and tectonic assemblages maps,
- mineral exploration assessment files and reports of exploration work,
- mineral deposit and occurrence records,
- summary drill hole records compiled from reports in the assessment files, and
- geochemical analyses from samples collected by Ontario Geological Survey staff.

In addition to continuously adding data, the Ministry is preparing to port the information to the Internet in the year 2000 through the Earth Resources Mineral Exploration webSite (ERMES). This project will provide worldwide access 24 hours a day to the MNDM geoscience database from the convenience of the client's office.

### GEO ENTERPRISES ONTARIO

The Ontario government supports private sector companies pursuing international opportunities, and assists other jurisdictions involved in managing mining lands. It does this through GEO Enterprises Ontario, the business arm of the Ministry of Northern Development and Mines (MNDM).

In partnership with the private sector, GEO Enterprises Ontario markets and sells the expert technology and geo-analytical services MNDM has developed through a century of mining. From South Africa to Yemen and Saudi Arabia, GEO Enterprises Ontario provides a unique and significant service to the international community.

The CLAIMaps system provides exploration clients with online access to more than 2,700 claim maps. These maps show the location of approximately 42,000 active mining claims and the availability of land for prospecting and staking throughout Ontario. New information is uploaded to the website nightly, so maps are current to within 24 hours of being edited. Maps can be downloaded from the website as GIF images at no cost, or ordered (hardcopy) through the Provincial Recording Office in Sudbury.

## EXPLORATION AND DEVELOPMENT HIGHLIGHTS

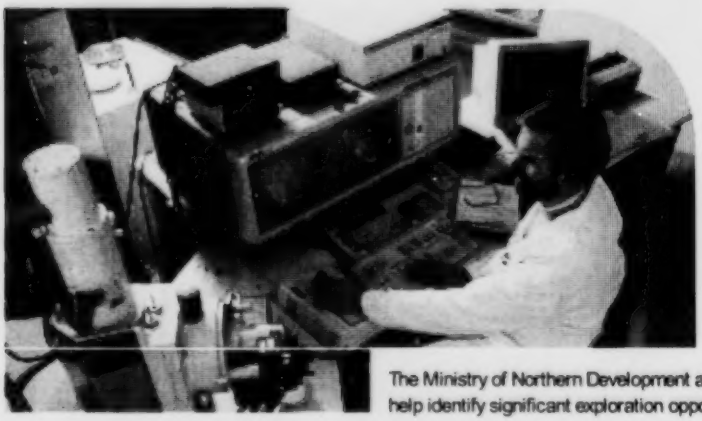
### MAJOR EXPLORATION PROJECTS

Cameco Gold Corporation continued with year four of an exploration program on the Knucklethumb Lake (Chaman Lake) gold project. The Big Bear gold occurrence, one of a number of structurally controlled gold occurrences on the property, was the focus of an integrated exploration program in 1999.

Monopros Limited took a small bulk sample from a kimberlite pipe near Attawapiskat and will return to the area to do more diamond exploration. To date, Monopros has discovered 16 kimberlite pipes in the area — 15 of these were diamond-bearing.

Planet Exploration Incorporated undertook a 1,195-metre drill program on their Red Lake East gold property. Anomalous gold was intersected in an intensely sheared, bleached and altered zone in high-grade metamorphosed ultramafic to mafic rocks.

# Competitive costs, people and infrastructure



The Ministry of Northern Development and Mines' world-class geoscience services help identify significant exploration opportunities in Ontario.

Ontario's considerable advantages make it a preferred location for mineral exploration, development and investment.

- Ontario's universities boast some of the world's foremost authorities on geology and mineral deposits. Sixty per cent of Ontario's workforce has attended university or a college of applied arts and technology in 1998.
- Ontario's business costs are highly competitive, including wages, employee health benefits, trucking, building, and tort costs.
- The World Economic Forum has ranked Canada first among the G-7 countries in transportation infrastructure. In December 1999, an independent study ranked Ontario's infrastructure as the best in Canada for supporting exploration and mining ventures. Many of Ontario's important mineral deposits are located near major transportation links, electric power lines and modern communities.
- About 300 mining-related companies in Ontario provide state-of-the-art analytical laboratories, environmental studies, mining contracting, equipment and other services in support of mineral exploration and mining.
- Ontario's location offers easy access to major markets in North America, Europe and the Pacific Rim.

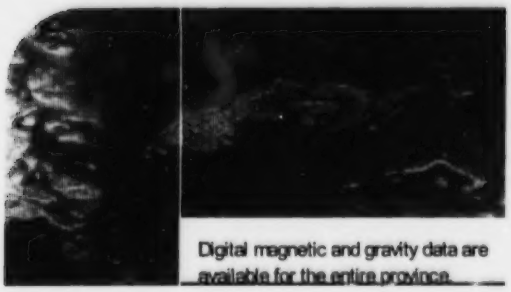
Ontario offers a superior quality of life. It is a safe place to live and has excellent public health care and education systems. For six years in a row, through 1999, Canada has ranked first among 160 nations in the United Nations' Human Development Index.

Houston Lake Mining Incorporated has a rare element pegmatite property at Pakeagama Lake, 160 kilometres north of Red Lake. Average grab sample values of 280 grams per tonne (0.028 per cent) tantalum oxide, 4,642 grams per tonne rubidium oxide, 817 grams per tonne cesium oxide, 366.4 grams per tonne beryllium oxide, and 124 grams per tonne tin were returned.

Band-Ore Resources Limited started a drill program on its Nym Lake platinum group element property near Atikokan. Four holes, totalling 2,000 feet (610 metres), are planned. Magnetic and induced polarization anomalies associated with a pyroxenite intrusion have returned grab samples up to 3.3 grams per tonne of palladium and platinum combined, 0.45 per cent copper, 0.8 per cent nickel and 2.9 grams per tonne silver.

Cameco Gold Incorporated will begin a 3,000-metre diamond drilling program of their Black Lake property in 2000, having completed a 2,000-metre drilling program and follow-up geological mapping in1999.

# Fast, easy access to information



Digital magnetic and gravity data are available for the entire province.

The Ontario Ministry of Northern Development and Mines (MNDM) provides the information that companies and investors need on Ontario's mineral deposits, geology, exploration assessment work, and geochemical and geophysical projects.

MNDM's Mines Library, Ontario Geological Survey offices, Mining Lands offices, and Mines and Minerals Information Centre house nearly 400,000 reports, maps and records.

The Earth Resources and Land Information System (ERLIS) allows fast, easy access to most of the Ministry's information at MNDM offices across Ontario. ERLIS contains over 1.5 million pages of documents and approximately 120,000 maps. Computer workstations provide fast retrieval and high visual resolution. ERLIS thematic data sets include:

- topographic bases at various scales for reference to other subjects of digital data,
- digital bedrock geology and tectonic assemblages maps,
- mineral exploration assessment files and reports of exploration work,
- mineral deposit and occurrence records,
- summary drill hole records compiled from reports in the assessment files, and
- geochemical analyses from samples collected by Ontario Geological Survey staff.

In addition to continuously adding data, the Ministry is preparing to port the information to the Internet in the year 2000 through the Earth Resources Mineral Exploration webSite (ERMES). This project will provide worldwide access 24 hours a day to the MNDM geoscience database from the convenience of the client's office.

### GEO ENTERPRISES ONTARIO

The Ontario government supports private sector companies pursuing international opportunities, and assists other jurisdictions involved in managing mining lands. It does this through GEO Enterprises Ontario, the business arm of the Ministry of Northern Development and Mines (MNDM).

In partnership with the private sector, GEO Enterprises Ontario markets and sells the expert technology and geo-analytical services MNDM has developed through a century of mining. From South Africa to Yemen and Saudi Arabia, GEO Enterprises Ontario provides a unique and significant service to the international community.

The CLAIMaps system provides exploration clients with online access to more than 2,700 claim maps. These maps show the location of approximately 42,000 active mining claims and the availability of land for prospecting and staking throughout Ontario. New information is uploaded to the website nightly, so maps are current to within 24 hours of being edited. Maps can be downloaded from the website as GIF images at no cost, or ordered (hardcopy) through the Provincial Recording Office in Sudbury.

## EXPLORATION AND DEVELOPMENT HIGHLIGHTS

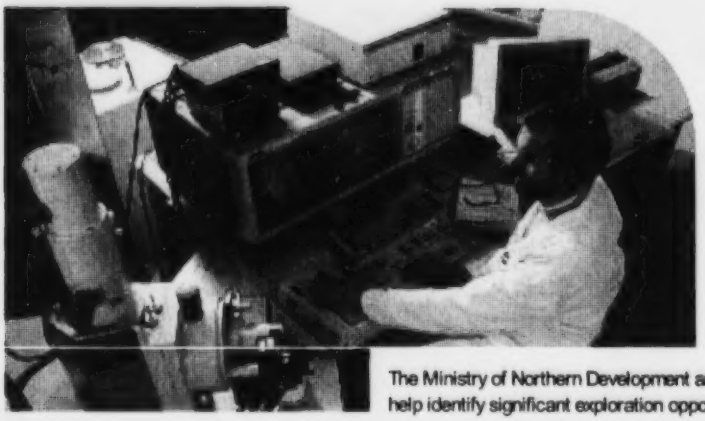
### MAJOR EXPLORATION PROJECTS

Camsco Gold Corporation continued with year four of an exploration program on the Knucklethumb Lake (Chaman Lake) gold project. The Big Bear gold occurrence, one of a number of structurally controlled gold occurrences on the property, was the focus of an integrated exploration program in 1999.

Monopros Limited took a small bulk sample from a kimberlite pipe near Attawapiskat and will return to the area to do more diamond exploration. To date, Monopros has discovered 16 kimberlite pipes in the area — 15 of these were diamond-bearing.

Planet Exploration Incorporated undertook a 1,195-metre drill program on their Red Lake East gold property. Anomalous gold was intersected in an intensely sheared, bleached and altered zone in high-grade metamorphosed ultramafic to mafic rocks.

# Competitive costs, people and infrastructure



The Ministry of Northern Development and Mines' world-class geoscience services help identify significant exploration opportunities in Ontario.

Ontario's considerable advantages make it a preferred location for mineral exploration, development and investment.

- Ontario's universities boast some of the world's foremost authorities on geology and mineral deposits. Sixty per cent of Ontario's workforce has attended university or a college of applied arts and technology in 1998.
- Ontario's business costs are highly competitive, including wages, employee health benefits, trucking, building, and tort costs.
- The World Economic Forum has ranked Canada first among the G-7 countries in transportation infrastructure. In December 1999, an independent study ranked Ontario's infrastructure as the best in Canada for supporting exploration and mining ventures. Many of Ontario's important mineral deposits are located near major transportation links, electric power lines and modern communities.
- About 300 mining-related companies in Ontario provide state-of-the-art analytical laboratories, environmental studies, mining contracting, equipment and other services in support of mineral exploration and mining.
- Ontario's location offers easy access to major markets in North America, Europe and the Pacific Rim.

Ontario offers a superior quality of life. It is a safe place to live and has excellent public health care and education systems. For six years in a row, through 1999, Canada has ranked first among 160 nations in the United Nations' Human Development Index.

Houston Lake Mining Incorporated has a rare element pegmatite property at Pakeagama Lake, 160 kilometres north of Red Lake. Average grab sample values of 280 grams per tonne (0.028 per cent) tantalum oxide, 4,642 grams per tonne rubidium oxide, 817 grams per tonne cesium oxide, 366.4 grams per tonne beryllium oxide, and 124 grams per tonne tin were returned.

Band-Ore Resources Limited started a drill program on its Nym Lake platinum group element property near Atikokan. Four holes, totalling 2,000 feet (610 metres), are planned. Magnetic and induced polarization anomalies associated with a pyroxenite intrusion have returned grab samples up to 3.3 grams per tonne of palladium and platinum combined, 0.45 per cent copper, 0.8 per cent nickel and 2.9 grams per tonne silver.

Cameco Gold Incorporated will begin a 3,000-metre diamond drilling program of their Black Lake property in 2000, having completed a 2,000-metre drilling program and follow-up geological mapping in 1999.

# Ontario's geology and mineral deposits

Ontario is dominated by rocks of the Precambrian Canadian Shield. Major provinces and belts include the Archean Superior Province; important elements of the Proterozoic Grenville, Penokean, and Trans-Hudson orogens; and the Mid-Continent Rift. Alkaline and kimberlitic igneous activity occurred during the Mid-Proterozoic era. Ontario's Precambrian rocks host gold and base metal deposits that rank with the best in the world.

Intense mountain-building activity in the Precambrian era was followed by deposits being laid down from shallow seas during the Paleozoic and Mesozoic eras. Shallow, circular Paleozoic basins developed on the shield, including the Hudson Bay and Moose River basins. The expanse of Paleozoic sedimentary rocks in southern Ontario is part of the Appalachian Basin, a remnant of a seaway that connected the Appalachian Basin to the eastern fringe of the Michigan Basin in the centre of the continent. Ontario's Paleozoic rocks host important industrial mineral deposits and provide aggregates vital to Ontario's construction industry.

Minor, but significant, igneous activity occurred during the Mesozoic era, including kimberlite emplacement during the Cretaceous period, and the development of alkaline intrusions along the Ottawa-Bonnechere graben in eastern Ontario and elsewhere in the province. Explorers have discovered a number of kimberlites containing diamonds in Ontario and diamond exploration has increased dramatically.

Ontario, like many northern regions, underwent several Quaternary glaciations. This resulted in excellent bedrock exposure in many places through glacial polishing and plucking. In other places, glaciation resulted in a veneer of glacial tills and glaciolacustrine clays which mask bedrock. Quaternary deposits are another important source of aggregate throughout Ontario.

## EXPLORATION AND DEVELOPMENT HIGHLIGHTS

### MAJOR EXPLORATION PROJECTS

Inco Limited continued to expand new nickel-copper discoveries immediately north and south of the Copper Cliff South Mine. The company also commenced an aggressive exploration project at the former Totten nickel-copper mine on the Worthington orebody.

Mustang Minerals Limited, Pacific North West Capital Corporation, Aquiline Resources Incorporated worked extensively on the River Valley mafic intrusion, east of Sudbury. Programs of linecutting, ground geophysical surveys, geological mapping, soil and lithogeochemical sampling, as well as diamond drilling were undertaken. The second area of exploration for platinum group elements was in the East Bull Lake and Agnew Lake area west of Sudbury. Mustang Minerals Limited and New Millenium Metals Corporation completed similar work to that undertaken at River Valley.

## SUPERIOR PROVINCE

The Archean Superior Province consists of granite-greenstone, sedimentary and plutonic subprovinces, bounded by shear zones, that are comparable to superterranes of modern orogens. The Superior Province was deformed by at least two orogenies or processes of mountain formation. They include an early event about 2.8 billion years ago and the 2.7 billion-year-old Kenoran Orogeny. The Kenoran event produced the Superior Province as we know it. Granite-greenstone and sedimentary subprovinces docked against one another and formed a stable craton.

## GREENSTONE BELTS

### *"ASSEMBLAGES" AND SYNGENETIC MINERAL DEPOSITS*

In the revolutionary re-appraisal of the province's geology reported in *Geology of Ontario*, greenstone belts were subdivided into "assemblages" similar to those used to arrive at an understanding of the detailed tectonics of the Cordillera of North America. Assemblages are composed of volcanic and sedimentary rocks laid down in a specific depositional environment over a limited time, and can commonly be traced tens to hundreds of kilometres within subprovinces. Assemblage contacts are stratigraphic (unconformities), tectonic or intrusive.

The assemblage approach to tectonic analysis in the Archean period has been used to relate specific assemblages to particular types of syngenetic mineral deposits. For example, using the assemblage concept and the geochronological database, the Ontario Geological Survey recently determined that all economic Superior Province volcanogenic massive sulphide (VMS) deposits are 2,750 to 2,700 million years old, and deposits are closely related to arc and back arc assemblages.

### *EPIGENETIC AND INTRUSION-RELATED DEPOSITS*

Epigenetic mineral deposits within granite-greenstone subprovinces are related to later events during the complex process of building greenstone belts. These events include plutonism and structural processes such as folding or faulting. The most important of the mineral deposits are the lode gold deposits spatially associated with major late shear zones. Archean rare element pegmatites are associated with over-thickened crust usually associated with subprovincial boundary zones. The Ontario Geological Survey recently discovered rare element pegmatites that are now being explored in the Separation Rapids area north of Kenora.

## SEDIMENTARY SUBPROVINCES

While most Ontario mineral production came from granite-greenstone subprovinces, recent work has revealed that sedimentary subprovinces may have significant mineral potential. These high-metamorphic-grade units have long been known for their rare element pegmatites, but recent work has suggested potential for sedimentary exhalative (SEDEX) sulphide deposits.

## PROTEROZOIC OROGENS

### *PENOKEAN*

The Penokean Orogen in Ontario consists of four groups of clastic sedimentary rocks and minor volcanic rocks known as the Huronian Supergroup, which formed along the southern margin of the Superior Province between 2.4 and 2.2 billion years ago. The lower part of the sequence — the Elliot Lake Group between Sault Ste. Marie, Sudbury and Cobalt — contains metavolcanic rocks, uraniferous conglomerates, and nickel-copper and platinum group elements-bearing mafic intrusive rocks. The south-facing Animikie Group iron formation and clastic units in the Thunder Bay area form a younger part of the Orogen.

### *TRANS-HUDSON*

A poorly exposed segment of the 1.8 billion-year-old Trans-Hudson Orogen lies along the northern flank of the Superior Province. This segment contains volcanic and intrusive rocks equivalent to those hosting the nickel deposits at Thompson, Manitoba.

### *SUDBURY IGNEOUS COMPLEX*

By far the most important event, about 1.85 billion years ago, was the development of the Sudbury Basin igneous rocks — considered by many to be the result of a major meteorite impact. The extraction of copper and nickel ores at Sudbury sustains the world's largest mining/industrial complex. Historic nickel production from the Sudbury Basin totals 9 million tonnes.

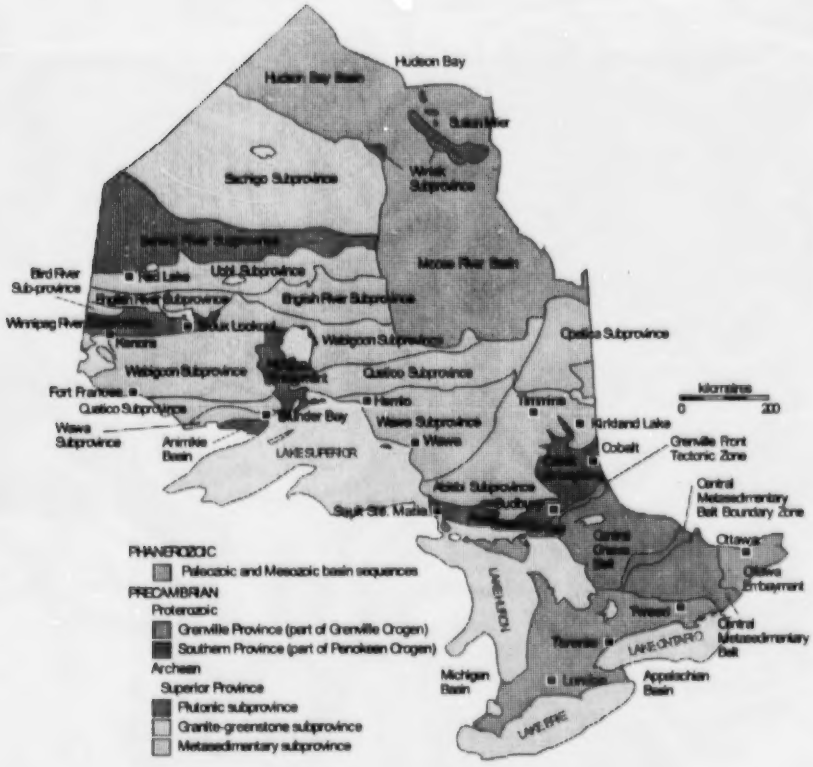
---

Diamond Lake Minerals Incorporated has defined a significant new graphite deposit in Bedford Township. Work done to date has included stripping, trenching, sampling, air-track drilling, bulk sampling, bench testing, reserve calculations and market research. Additional definition diamond drilling to confirm the reserves and acquisition of the necessary permitting is planned.

Early in 1999, Millstream Mines Limited began another deep drill program at the Potter Mine property in Munro Township. New drilling returned up to 7.82 metres of sulphide mineralization grading 1.96 per cent copper, 3.18 per cent zinc, 0.085 per cent cobalt and 0.53 ounces per ton silver. The mineralization is approximately 914 metres vertically below surface and 579 metres below the former mine bottom working level. An induced polarization anomaly east of the mine shaft is currently being tested with deep diamond drilling.

Cross Lake Minerals Ltd. began a 700-metre drill program on their Sheraton Township property. The company is targeting a 500-metre long electromagnetic target northeast of the Cross Lake Zone.

# Ontario's geology and mineral deposits




Ontario is dominated by rocks of the Precambrian Canadian Shield. Major provinces and belts include the Archean Superior Province; important elements of the Proterozoic Grenville, Penokean, and Trans-Hudson orogens; and the Mid-Continent Rift. Alkaline and kimberlitic igneous activity occurred during the Mid-Proterozoic era. Ontario's Precambrian rocks host gold and base metal deposits that rank with the best in the world.

Intense mountain-building activity in the Precambrian era was followed by deposits being laid down from shallow seas during the Paleozoic and Mesozoic eras. Shallow, circular Paleozoic basins developed on the shield, including the Hudson Bay and Moose River basins. The expanse of Paleozoic sedimentary rocks in southern Ontario is part of the Appalachian Basin, a remnant of a seaway that connected the Appalachian Basin to the eastern fringe of the Michigan Basin in the centre of the continent. Ontario's Paleozoic rocks host important industrial mineral deposits and provide aggregates vital to Ontario's construction industry.

Minor, but significant, igneous activity occurred during the Mesozoic era, including kimberlite emplacement during the Cretaceous period, and the development of alkaline intrusions along the Ottawa-Bonnechere graben in eastern Ontario and elsewhere in the province. Explorers have discovered a number of kimberlites containing diamonds in Ontario and diamond exploration has increased dramatically.

Ontario, like many northern regions, underwent several Quaternary glaciations. This resulted in excellent bedrock exposure in many places through glacial polishing and plucking. In other places, glaciation resulted in a veneer of glacial tills and glaciolacustrine clays which mask bedrock. Quaternary deposits are another important source of aggregate throughout Ontario.

## EXPLORATION AND DEVELOPMENT HIGHLIGHTS

### MAJOR EXPLORATION PROJECTS

Inco Limited continued to expand new nickel-copper discoveries immediately north and south of the Copper Cliff South Mine. The company also commenced an aggressive exploration project at the former Totten nickel-copper mine on the Worthington orebody.

Mustang Minerals Limited, Pacific North West Capital Corporation, Aquiline Resources Incorporated worked extensively on the River Valley mafic intrusion, east of Sudbury. Programs of linecutting, ground geophysical surveys, geological mapping, soil and lithogeochemical sampling, as well as diamond drilling were undertaken. The second area of exploration for platinum group elements was in the East Bull Lake and Agnew Lake area west of Sudbury. Mustang Minerals Limited and New Millenium Metals Corporation completed similar work to that undertaken at River Valley.

## SUPERIOR PROVINCE

The Archean Superior Province consists of granite-greenstone, sedimentary and plutonic subprovinces, bounded by shear zones, that are comparable to superterranes of modern orogens. The Superior Province was deformed by at least two orogenies or processes of mountain formation. They include an early event about 2.8 billion years ago and the 2.7 billion-year-old Kenoran Orogeny. The Kenoran event produced the Superior Province as we know it. Granite-greenstone and sedimentary subprovinces docked against one another and formed a stable craton.

## GREENSTONE BELTS

### *"ASSEMBLAGES" AND SYNGENETIC MINERAL DEPOSITS*

In the revolutionary re-appraisal of the province's geology reported in *Geology of Ontario*, greenstone belts were subdivided into "assemblages" similar to those used to arrive at an understanding of the detailed tectonics of the Cordillera of North America. Assemblages are composed of volcanic and sedimentary rocks laid down in a specific depositional environment over a limited time, and can commonly be traced tens to hundreds of kilometres within subprovinces. Assemblage contacts are stratigraphic (unconformities), tectonic or intrusive.

The assemblage approach to tectonic analysis in the Archean period has been used to relate specific assemblages to particular types of syngenetic mineral deposits. For example, using the assemblage concept and the geochronological database, the Ontario Geological Survey recently determined that all economic Superior Province volcanogenic massive sulphide (VMS) deposits are 2,750 to 2,700 million years old, and deposits are closely related to arc and back arc assemblages.

### *EPIGENETIC AND INTRUSION-RELATED DEPOSITS*

Epigenetic mineral deposits within granite-greenstone subprovinces are related to later events during the complex process of building greenstone belts. These events include plutonism and structural processes such as folding or faulting. The most important of the mineral deposits are the lode gold deposits spatially associated with major late shear zones. Archean rare element pegmatites are associated with over-thickened crust usually associated with subprovincial boundary zones. The Ontario Geological Survey recently discovered rare element pegmatites that are now being explored in the Separation Rapids area north of Kenora.

## SEDIMENTARY SUBPROVINCES

While most Ontario mineral production came from granite-greenstone subprovinces, recent work has revealed that sedimentary subprovinces may have significant mineral potential. These high-metamorphic-grade units have long been known for their rare element pegmatites, but recent work has suggested potential for sedimentary exhalative (SEDEX) sulphide deposits.

## PROTEROZOIC OROGENS

### *PENOKEAN*

The Penokean Orogen in Ontario consists of four groups of clastic sedimentary rocks and minor volcanic rocks known as the Huronian Supergroup, which formed along the southern margin of the Superior Province between 2.4 and 2.2 billion years ago. The lower part of the sequence — the Elliot Lake Group between Sault Ste. Marie, Sudbury and Cobalt — contains metavolcanic rocks, uraniferous conglomerates, and nickel-copper and platinum group elements-bearing mafic intrusive rocks. The south-facing Animikie Group iron formation and clastic units in the Thunder Bay area form a younger part of the Orogen.

### *TRANS-HUDSON*

A poorly exposed segment of the 1.8 billion-year-old Trans-Hudson Orogen lies along the northern flank of the Superior Province. This segment contains volcanic and intrusive rocks equivalent to those hosting the nickel deposits at Thompson, Manitoba.

### *SUDBURY IGNEOUS COMPLEX*

By far the most important event, about 1.85 billion years ago, was the development of the Sudbury Basin igneous rocks — considered by many to be the result of a major meteorite impact. The extraction of copper and nickel ores at Sudbury sustains the world's largest mining/industrial complex. Historic nickel production from the Sudbury Basin totals 9 million tonnes.

---

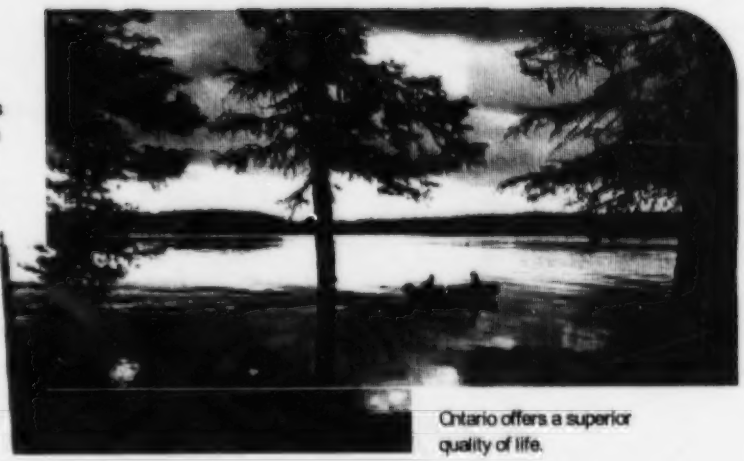
Diamond Lake Minerals Incorporated has defined a significant new graphite deposit in Bedford Township. Work done to date has included stripping, trenching, sampling, air-track drilling, bulk sampling, bench testing, reserve calculations and market research. Additional definition diamond drilling to confirm the reserves and acquisition of the necessary permitting is planned.

Early in 1999, Millstream Mines Limited began another deep drill program at the Potter Mine property in Munro Township. New drilling returned up to 7.82 metres of sulphide mineralization grading 1.96 per cent copper, 3.18 per cent zinc, 0.085 per cent cobalt and 0.53 ounces per ton silver. The mineralization is approximately 914 metres vertically below surface and 579 metres below the former mine bottom working level. An induced polarization anomaly east of the mine shaft is currently being tested with deep diamond drilling.

Cross Lake Minerals Ltd. began a 700-metre drill program on their Sheraton Township property. The company is targeting a 500-metre long electromagnetic target northeast of the Cross Lake Zone.

*MID-CONTINENT RIFT*

The Mid-Continent Rift, centred on Lake Superior, is 1.1 billion years old. A 2,000-kilometre long structure, the rift is characterized by a series of half grabens filled with continental flood basalts and clastic sediments up to 30 kilometres thick. This represents one of the world's largest plateau basalt eruptions. A related failed arm, centred on the Lake Nipigon area, contains diabase sills and related intrusive rocks that host copper, nickel and platinum group element mineralization south of Thunder Bay. During this era, kimberlites were emplaced in the Attawapiskat area of the Hudson Bay Lowlands.



Ontario offers a superior quality of life.

*GRENVILLE PROVINCE*

The Mid-Proterozoic-age Grenville Province is divided, from south to north, into the Central Metasedimentary Belt, the Central Gneiss Belt and the Grenville Front Tectonic Zone.

The Central Metasedimentary Belt comprises volcanic and sedimentary units cut by various syntectonic, late tectonic and post-tectonic plutons. It can be subdivided into five terranes, each with unique combinations of volcanic and sedimentary units ranging in age from about 1.4 to 1.25 billion years old. Arc-derived volcanism and extensive areas of shallow-water platformal sediments, including marbles, characterize the belt.

The Central Gneiss Belt has high-metamorphic-grade quartzofeldspathic gneisses, mainly of igneous origin, which are subdivided into several domains and terranes by major shear zones. The belt is composed of reworked Archean and Paleoproterozoic gneisses to the north, succeeded to the south by units that are 1.8 to 1.6, and 1.4 billion years old.

The Grenville Front Tectonic Zone is a region of steeply dipping, highly tectonized rocks from midcrustal levels exposed in proximity to the Southern Province contact.

The Grenville Province contains units from a spectrum of crustal depths ranging from mid-level to shallow. Mineral deposits range from syngenetic massive sulphide and carbonate hosted lead-zinc deposits to deeper crustal-level graphite and anorthosite-related mineralization. Because of the presence of carbonate bearing sedimentary rocks, volcanic country rocks and abundant late intrusions, the Grenville Province now hosts a wide variety of industrial mineral deposits including wollastonite, talc, calcite, muscovite, kyanite, staurolite and garnet.

## EXPLORATION AND DEVELOPMENT HIGHLIGHTS

Triex Resources Limited completed an evaluation of their Minnitaki Lake property. The work has confirmed the presence of significant gold mineralization in the area and provided data for resolution of follow-up drilling targets.

### NEW QUARRIES

Canada Brick began work on constructing a $51-million (150 million brick units per year) plant at their new Aldershot West Quarry. The plant will be in operation by late 2000.

In 1999, Global Stone Ingersoll Limited continued development of the new Millennium Quarry. The high-purity limestone deposit will feed the company's Ingersoll Lime Plant. The plant processed the limestone removed during quarry development in 1999.

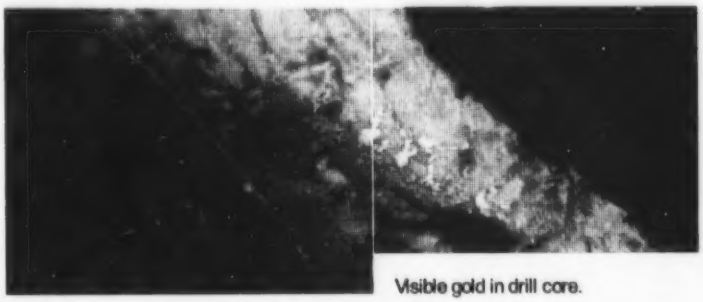
# What's happening in exploration and development

Ontario is one of the premier mining and exploration jurisdictions in the world and indications are that Ontario's share of Canadian exploration expenditures will continue to increase.

Initial indications for 1999 suggest that Ontario and Quebec are jointly in the lead for general and minesite exploration expenditures at $106 million. Spending by Ontario's senior sector increased by eight per cent from 1998 levels and accounts for more than three-quarters of all Ontario exploration expenditures. Increases in commodity prices for gold and nickel are expected to influence the industry's confidence in proceeding with planned exploration expenditures and projects.

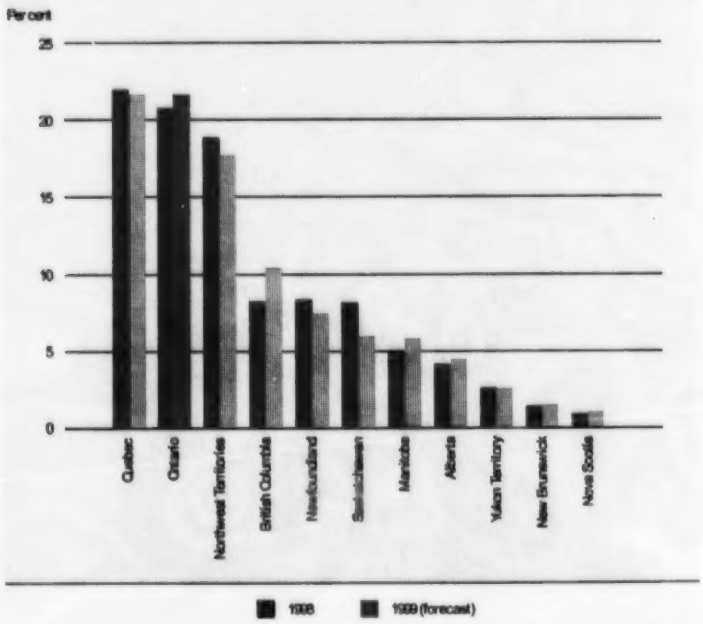
Initial figures for 1998 indicate the value of exploration in Ontario at $127.6 million and the total value of mineral production stable, at $5.1 billion.

At the end of 1998, active claim units in Ontario exceeded 174,000. The Ontario Ministry of Northern Development and Mines (MNDM) recorded more than $55 million worth of assessment work on those units. Much of the exploration activity was taking place in traditional mining camps such as Red Lake, Timmins, Kirkland Lake and Sudbury.



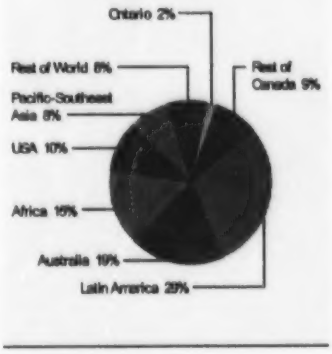
Visible gold in drill core.

PERCENTAGE OF CANADIAN EXPLORATION EXPENDITURES




Source: Ontario Ministry of Northern Development and Mines

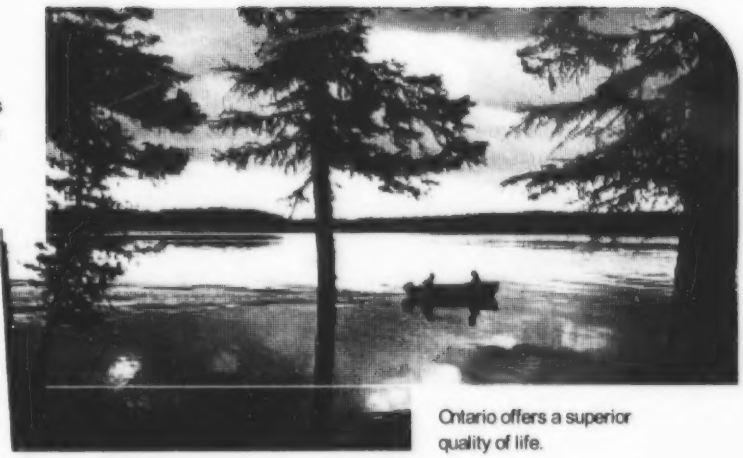
1999 WORLDWIDE EXPLORATION EXPENDITURES




Source: Metals Economics Group

*MID-CONTINENT RIFT*

The Mid-Continent Rift, centred on Lake Superior, is 1.1 billion years old. A 2,000-kilometre long structure, the rift is characterized by a series of half grabens filled with continental flood basalts and clastic sediments up to 30 kilometres thick. This represents one of the world's largest plateau basalt eruptions. A related failed arm, centred on the Lake Nipigon area, contains diabase sills and related intrusive rocks that host copper, nickel and platinum group element mineralization south of Thunder Bay. During this era, kimberlites were emplaced in the Attawapiskat area of the Hudson Bay Lowlands.



Ontario offers a superior quality of life.

*GRENVILLE PROVINCE*

The Mid-Proterozoic-age Grenville Province is divided, from south to north, into the Central Metasedimentary Belt, the Central Gneiss Belt and the Grenville Front Tectonic Zone.

The Central Metasedimentary Belt comprises volcanic and sedimentary units cut by various syntectonic, late tectonic and post-tectonic plutons. It can be subdivided into five terranes, each with unique combinations of volcanic and sedimentary units ranging in age from about 1.4 to 1.25 billion years old. Arc-derived volcanism and extensive areas of shallow-water platformal sediments, including marbles, characterize the belt.

The Central Gneiss Belt has high-metamorphic-grade quartzofeldspathic gneisses, mainly of igneous origin, which are subdivided into several domains and terranes by major shear zones. The belt is composed of reworked Archean and Paleoproterozoic gneisses to the north, succeeded to the south by units that are 1.8 to 1.6, and 1.4 billion years old.

The Grenville Front Tectonic Zone is a region of steeply dipping, highly tectonized rocks from midcrustal levels exposed in proximity to the Southern Province contact.

The Grenville Province contains units from a spectrum of crustal depths ranging from mid-level to shallow. Mineral deposits range from syngenetic massive sulphide and carbonate hosted lead-zinc deposits to deeper crustal-level graphite and anorthosite-related mineralization. Because of the presence of carbonate bearing sedimentary rocks, volcanic country rocks and abundant late intrusions, the Grenville Province now hosts a wide variety of industrial mineral deposits including wollastonite, talc, calcite, muscovite, kyanite, staurolite and garnet.

## EXPLORATION AND DEVELOPMENT HIGHLIGHTS

Triex Resources Limited completed an evaluation of their Minnitaki Lake property. The work has confirmed the presence of significant gold mineralization in the area and provided data for resolution of follow-up drilling targets.

### NEW QUARRIES

Canada Brick began work on constructing a $51-million (150 million brick units per year) plant at their new Aldershot West Quarry. The plant will be in operation by late 2000.

In 1999, Global Stone Ingersoll Limited continued development of the new Millennium Quarry. The high-purity limestone deposit will feed the company's Ingersoll Lime Plant. The plant processed the limestone removed during quarry development in 1999.

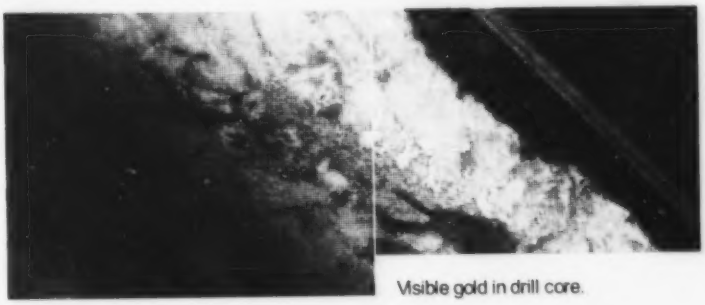
# What's happening in exploration and development

Ontario is one of the premier mining and exploration jurisdictions in the world and indications are that Ontario's share of Canadian exploration expenditures will continue to increase.

Initial indications for 1999 suggest that Ontario and Quebec are jointly in the lead for general and minesite exploration expenditures at $106 million. Spending by Ontario's senior sector increased by eight per cent from 1998 levels and accounts for more than three-quarters of all Ontario exploration expenditures. Increases in commodity prices for gold and nickel are expected to influence the industry's confidence in proceeding with planned exploration expenditures and projects.

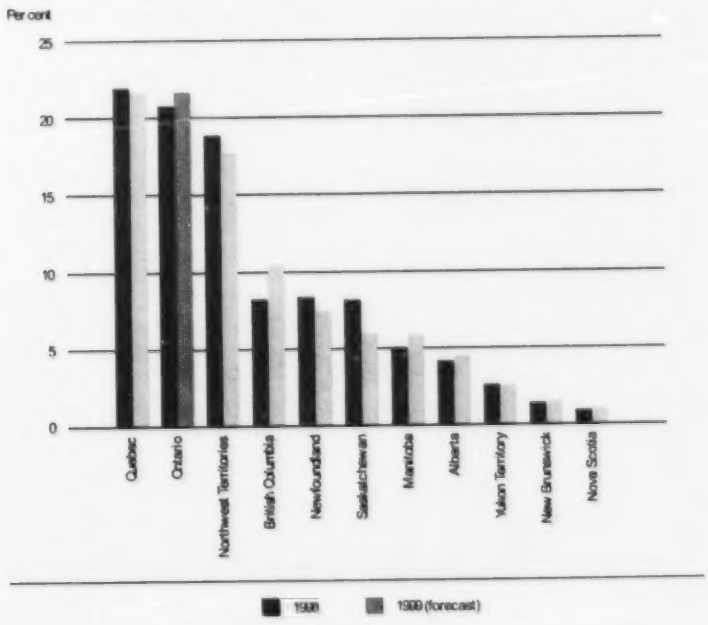
Initial figures for 1998 indicate the value of exploration in Ontario at $127.6 million and the total value of mineral production stable, at $5.1 billion.

At the end of 1998, active claim units in Ontario exceeded 174,000. The Ontario Ministry of Northern Development and Mines (MNDM) recorded more than $55 million worth of assessment work on those units. Much of the exploration activity was taking place in traditional mining camps such as Red Lake, Timmins, Kirkland Lake and Sudbury.



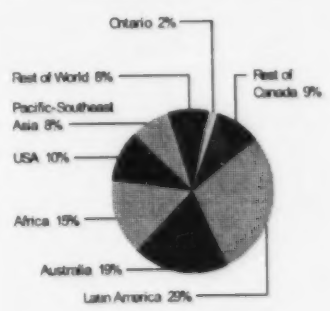
Visible gold in drill core.

PERCENTAGE OF CANADIAN EXPLORATION EXPENDITURES



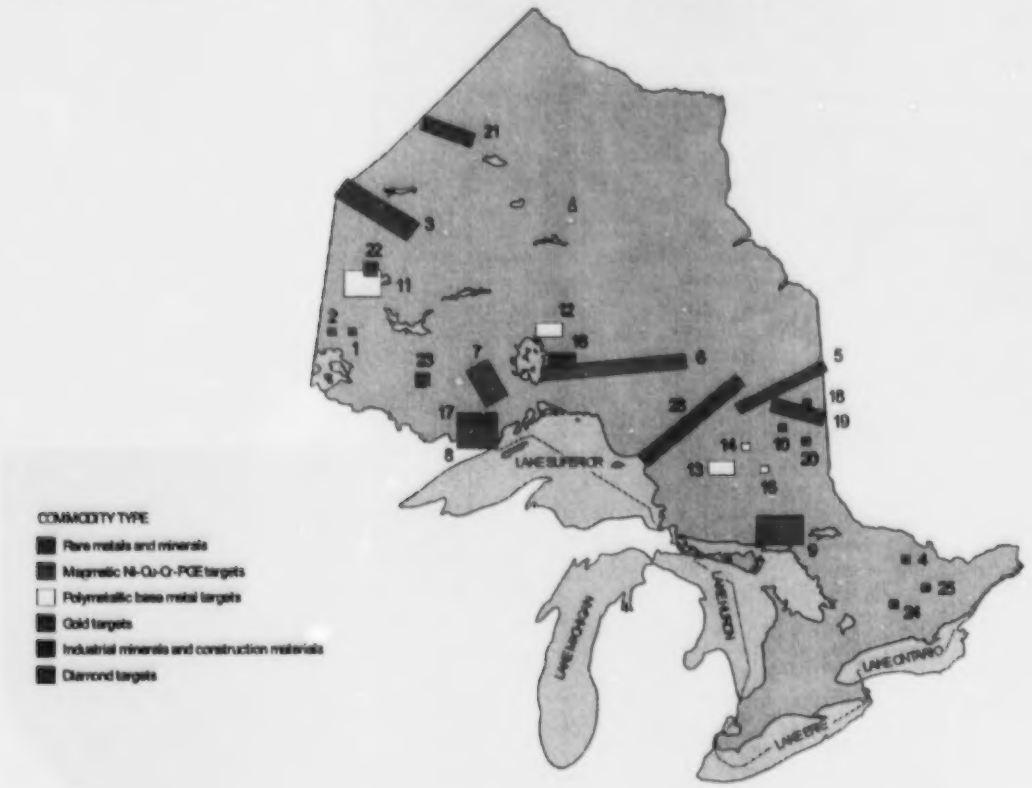

Source: Ontario Ministry of Northern Development and Mines

1999 WORLDWIDE EXPLORATION EXPENDITURES




Source: Metals Economics Group

# Exploration recommendations for 2000




## RARE METALS AND MINERALS

The discovery of complex, rare element pegmatites in the Separation Lake area of northwestern Ontario has outlined this as a potentially significant exploration target. Rare metals and minerals, notably petalite, Li, Rb, Ta and Nb, are strongly enriched in the host intrusive and both the Big Whopper and Big Mac pegmatites.

Contact: Fred Breaks
Tel: (705) 670-5930; Fax: (705) 670-5905
E-mail: fred.breaks@ndm.gov.on.ca

An extension of the Big Mac pegmatite system, north of Kenora, onto the ground of Champion Bear Resources suggests additional deposits may be found in this pegmatite group. Indications of Ta mineralization have been detected.

Contact: Fred Breaks
Tel: (705) 670-5930; Fax: (705) 670-5905
E-mail: fred.breaks@ndm.gov.on.ca

Recent work has indicated significant potential for rare element pegmatites at Pakeagama Lake in the Bear Head fault zone, north of Red Lake. The 140-kilometre long zone separates the Berens River and the Sachigo subprovinces. Grab sample assays released by Houston Lake Mining returned an average value of 280 g/t (0.028 percent) tantalum oxide, 4642 g/t rubidium oxide, 817 g/t cesium oxide, 3864 g/t beryllium oxide, and 124 g/t tin. The entire length of the Bear Head fault zone warrants exploration for rare metal pegmatites.

Contact: Fred Breaks
Tel: (705) 670-5930; Fax: (705) 670-5905
E-mail: fred.breaks@ndm.gov.on.ca
Contact: Carmen Storey
Tel: (807) 727-3272; Fax: (807) 727-3553
E-mail: carmen.storey@ndm.gov.on.ca

There are numerous rare element occurrences in southern Ontario associated with pegmatite dykes. Two well-known beryl-bearing pegmatite dykes in Lyndoch Township were commercially mined between 1935 and 1950. Analysis of the beryl samples from one of the properties yielded 14.38% BeO and 0.18% Li$_2$O. Further examination of the numerous occurrences in the area is recommended.

Contact: Pam Sangster
Tel: (613) 478-5238; Fax: (613) 478-2873
E-mail: pam.sangster@ndm.gov.on.ca

Several occurrences of rare metal pegmatites are noted in the Cochrane to Hearst area. The pegmatites are spatially associated with the boundary between the Abitibi/Wawa and Quetico subprovinces. The structural setting is reminiscent of rare metal pegmatite occurrences in the Separation Lake area of northwestern Ontario and may be worth examining for similar deposits.

Contact: Brian Atkinson
Tel: (705) 235-1619; Fax: (705) 235-1620
E-mail: brian.atkinson@ndm.gov.on.ca

MAGMATIC NI-CU-CR-PGE

6 Preliminary evaluation of airborne geophysical data and regional geochemical survey results indicate the potential presence of mafic intrusive-hosted PGE mineralization along the Wabigoon-Quetico subprovince boundary, from Lake Nipigon to Hearst. Only minimal exploration work is documented in the area.

Contact: Gerry White
Tel: (807) 475-1331
E-mail: gerry.white@ndm.gov.on.ca

7 Recent prospecting and exploration of Archean mafic to ultramafic intrusions in the Wabigoon, Quetico and Wawa subprovinces have recently generated significant new PGE targets. These include Samuels Lake, Legris Lake and Bulldozer Lake. Updated reserve figures for the Lac des Iles mine, were recently released. They now stand at 94.1 million tonnes @ 1.66 g/t Pd, 0.18 g/t Pt, 0.14 g/t Au, 0.052% Cu and 0.053% Ni.

Contact: Bernie Schnieders
Tel: (807) 475-1102
E-mail: bernie.schnieders@ndm.gov.on.ca

8 Mesoproterozoic, mafic intrusion-hosted, magmatic sulphide targets in the Nipigon Plate area of Thunder Bay have been generated from geoscientific and exploration work. A variety of sub-volcanic, mafic to ultramafic intrusions are situated below an extensive flood basalt sequence. This environment is geologically similar to Noril'sk, Siberia. Deposits such as Great Lakes Nickel (41.4 million tonnes @ 0.344% Cu, 0.183% Ni, 0.69 g/t Pd, 0.21 g/t Pt) and Marathon (44 million tonnes @ 0.37% Cu and 0.047% Ni) have already been identified in the area.

Contact: Bernie Schnieders
Tel: (807) 475-1102
E-mail: bernie.schnieders@ndm.gov.on.ca

9 Mapping of the River Valley gabbro-anorthosite, east of Sudbury, has revealed PGE mineralization to be associated with the primary intrusive contacts. There is additional potential for PGE mineralization in leucogabbroic units of the body. Grab sampling of the intrusion returned values as high as 12.6 g/t Pt+Pd+Rh. Intensive exploration in the area continues.

Contact: Mike Easton
Tel: (705) 670-5995; Fax: (705) 670-5905
E-mail: mike.easton@ndm.gov.on.ca

10 The Windward PGE-Cr showing located in northwest Nordica Township hosts a Pt-Pd sulphide and a chromite-rich mineralized zone in leucocratic gabbro. Reported surface grab samples assayed up to 0.3% Cu, 0.3% Ni and 1.1 ppm Pd and up to 20% $Cr_2O_3$ over 2 metres, respectively. The host gabbroic rocks in the showing area are manifested as a moderate magnetic high. Similar moderate aeromagnetic highs in the area require follow-up.

Contact: Gerhard Meyer
Tel: (705) 568-4516
E-mail: gerhard.meyer@ndm.gov.on.ca
Contact: David Guindon
Tel: (705) 568-4518
E-mail: dave.guindon@ndm.gov.on.ca

POLYMETALLIC BASE METAL (VOLCANIC, SEDIMENTARY, INTRUSIVE)

11 Base metal-favourable rhyolites have recently been discovered in several locations within the Confederation Assemblage along the south margin of the Red Lake greenstone belt. Mapping has disclosed hydrothermally altered proximal facies units in the vicinity of Madsen, Ontario; exhalite units in several locations especially Heyson Township; and previously unknown Zn-Cu showings.

Contact: Jack Parker
Tel: (705) 670-5878; Fax: (705) 670-5905
E-mail: jack.parker@ndm.gov.on.ca

12 A new stratigraphic, structural and alteration model has been developed for the VMS mineralization at Marshall Lake, northeast of Lake Nipigon. Application of the model through new geophysical surveys and geologically based exploration may uncover new deposits in the area.

Contact: Greg Stott
Tel: (705) 670-5978; Fax: (705) 670-5905
E-mail: greg.stott@ndm.gov.on.ca

13 The recognition high-silica rhyolites in Chester, Poitier and Yeo townships and the coincidence of variable magnetite-chlorite-epidote-quartz-sericite alteration within the Chester granitoid complex are interpreted as positive indicators for base metal mineralization within the southern Swayze Greenstone belt. Base metal exploration in the area has focussed mainly on base metals associated with iron formation.

Contact: Ann Wilson
Tel: (705) 235-1614
E-mail: ann.wilson@ndm.gov.on.ca

14 High silica rhyolites in Denton Township of the Abitibi subprovince may host potential for VMS mineralization. Newly recognized felsic to ultramafic volcanics of the Kidd-Munro assemblage in Tyrell Township of the Shining Tree greenstone belt have good volcanogenic massive sulphide potential.

Contact: John Ayer
Tel: (705) 670-5998; Fax: (705) 670-5905
E-mail: john.ayer@ndm.gov.on.ca

15 Widespread hydrothermal alteration and copper mineralization in felsic to intermediate metavolcanic rocks of the Deloro Assemblage in Macmurchy Township have been examined by KRL Resources Corp. Exploration of extensions of this unit into Churchill Township is recommended.

Contact: Glen Johns
Tel: (705) 670-5980; Fax: (705) 670-5905
E-mail: glen.johns@ndm.gov.on.ca

GOLD (HYDROTHERMAL, LODE)

16 Large deformation zones are the main control for gold mineralization in the Beardmore-Geraldton area. The Brookbank deformation zone, Watson Lake fault and Barton Bay Deformation Zone have the potential to host significant gold mineralization and merit further exploration.

Contact: John Mason
Tel: (807) 475-1331
E-mail: john.mason@ndm.gov.on.ca

17 The Matawin gold belt, west of Thunder Bay, and its "Timiskaming-style" host rocks have been compared to the Timmins and Kirkland Lake gold camps. Deposits in these areas are related to major, regional structures ("breaks"), splay faults, flexures and cross-structures. Gold exploration should concentrate on the unconformable,

fault-bounded contact between the "Temiskaming" rocks and the older, Keewatin, metavolcanic rocks to the south.

Contact: Bernie Schnieders
Tel: (807) 475-1102
E-mail: bernie.schnieders@ndm.gov.on.ca
Contact: Andy Bajc
Tel: (705) 670-5980
E-mail: andy.bajc@ndm.gov.on.ca

A number of occurrences of auriferous quartz boulders along the shore of Lake Abitibi, the well-documented Milligan gold-bearing quartz boulders and auriferous esker sand and gravel in the northwest part of Lake Abitibi indicate the potential for gold deposits up-ice from this location. Multiple sources suggest the potential for new gold discoveries in the region.

Contact: Gerhard Meyer
Tel: (705) 568-4516
E-mail: gerhard.meyer@ndm.gov.on.ca

The north branch of the Destor-Porcupine fault zone, has a minimum length of 40 kilometres and is highly prospective for Archean lode-gold deposits. Most significant gold deposits in the Timmins gold camp occur up to several kilometres north of the Destor-Porcupine Fault Zone on sub-parallel splay faults. The north branch, Destor-Porcupine Fault Zone, is north of the two operating mines in Holloway Township. Gold prospecting along the Porcupine-Destor fault between the Glimmer mine and the Royal Oak open pit to the east of Matheson is recommended.

Contact: Gerhard Meyer
Tel: (705) 568-4516
E-mail: gerhard.meyer@ndm.gov.on.ca
Contact: Ben Berger
Tel: (705) 670-5960; Fax: (705) 670-5905
E-mail: ben.berger@ndm.gov.on.ca

All high-strain zones within the Swayze greenstone belt are excellent targets for gold mineralization. The Ridout high strain zone, located in the southwestern part of the belt, is a particularly good target because it has been interpreted to be the westward continuation of the Larder-Kirkland-Matachewan fault.

Contact: Ann Wilson
Tel: (705) 235-1614
E-mail: ann.wilson@ndm.gov.on.ca

Former gold producers in the region north of Red Lake display high average grades. Recent mapping has identified two major structures in far northwestern Ontario, the Kenyon fault structure and the Stull-Wunnummin fault. Both structures are the site of past production or drill-indicated reserves. Alteration and assay data suggest further exploration is warranted.

Contact: Carmen Storey
Tel: (807) 727-3272; Fax: (807)727-3553
E-mail: carmen.storey@ndm.gov.on.ca
Contact: Denver Stone
Tel: (705) 670-5948; Fax: (705) 670-5905
E-mail: denver.stone@ndm.gov.on.ca

Aluminous alteration in mafic metavolcanic rocks of the Ball Assemblage is similar to that observed at the Madsen Mine, in Red Lake, raising the possibility of similar deposits in the area. Widely spaced, high-grade, gold-bearing veins related to conjugate shears raise the possibility of large tonnage low-grade deposits in the west end of the Red Lake greenstone belt (e.g. the Heath property) being present.

Contact: Jack Parker
Tel: (705) 670-5978; Fax: (705) 670-5905
E-mail: jack.parker@ndm.gov.on.ca

A newly discovered extension of the Marmion fault, north of Lumby Lake, has potential for lode gold mineralization.

Contact: Denver Stone
Tel: (705) 670-5948; Fax: (705) 670-5905
E-mail: denver.stone@ndm.gov.on.ca

## INDUSTRIAL MINERALS AND CONSTRUCTION MATERIALS

World reserves of natural rutile are rapidly declining and titaniferous slag and synthetic rutile produced from the beneficiation of ilmenite are gaining prominence as high-grade feedstock. A number of ilmenite occurrences have been identified in southeastern Ontario. Exploration of one such occurrence by the Canadian Nickel Company in the early 1980s defined reserves of 13.2 million tonnes of 21.7% $TiO_2$. Further evaluation of these occurrences is recommended.

Contact: Pam Sangster
Tel: (613) 478-5236; Fax: (613) 478-2873
E-mail: pam.sangster@ndm.gov.on.ca

Two muscovite deposits have been identified in the pelitic schists of the Flinton Group near Tweed and Fernleigh. The schists contain ancillary garnet, sillimanite, feldspar, staurolite and magnetite, which have economic potential. The muscovite unit near Fernleigh and Ardoch has a strike length of eight kilometres and should be further explored.

Contact: Pam Sangster
Tel: (613) 478-5236; Fax: (613) 478-2873
E-mail: pam.sangster@ndm.gov.on.ca

Many granite dimension stone areas across the province have high granite dimension stone potential in a variety of colours and textures including: the Kenora, Ear Falls, Ignace and Marathon areas of northwestern Ontario; the Sudbury and North Bay areas of northeastern Ontario; and the Parry Sound, Kingston, Madoc, Bancroft and Bracebridge areas of southeastern Ontario.

Many marble dimension stone potential deposits are found in the Central Metasedimentary Belt of the Grenville Province, the Paleozoic rocks of southern Ontario, Huronian carbonate rocks in northeastern Ontario and Precambrian marbles in northeastern and northwestern Ontario.

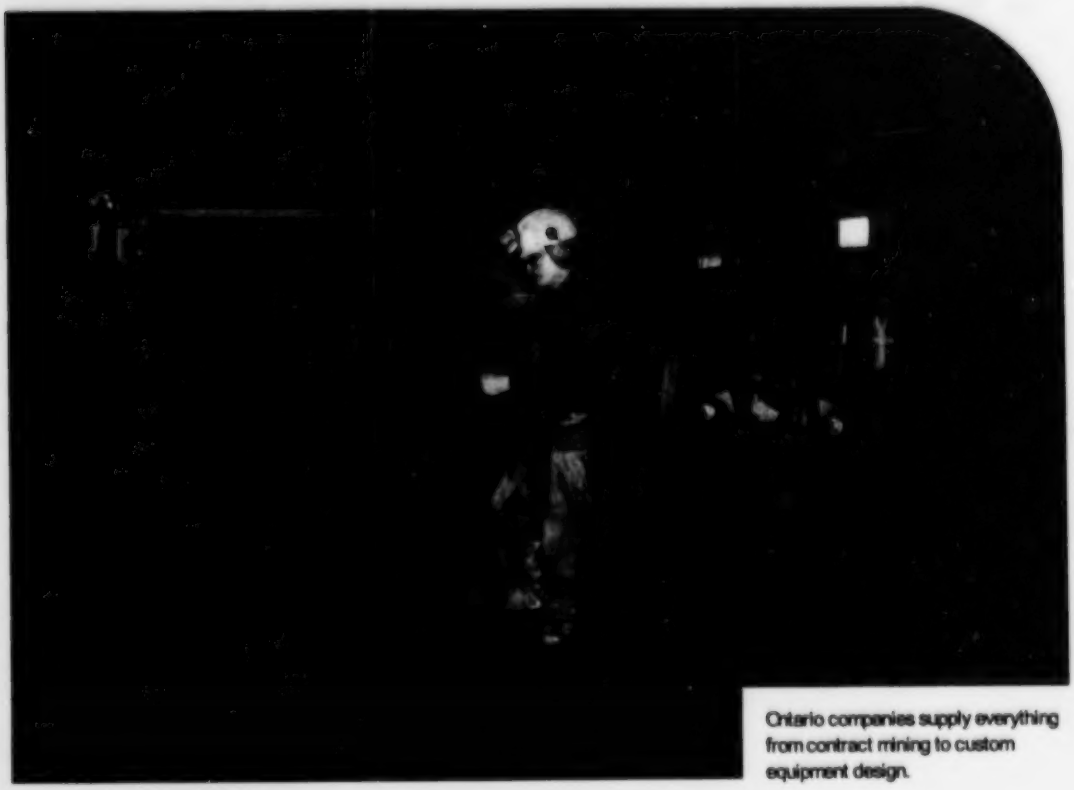
Contact: Myra Gerow
Tel: (705) 670-5928; Fax: (705) 670-5903
E-mail: myra.gerow@ndm.gov.on.ca

## DIAMONDIFEROUS DEPOSITS

The widely dispersed micro diamonds in glacial overburden throughout Ontario suggest that viable exploration discoveries of diamond-bearing kimberlite will be made. It is recommended that the area from Wawa through Kapuskasing has high potential for hosting diamond-bearing kimberlite. Regional surveys recently completed and underway in late 1999 were expected to help in the identification of targets that may lead to the discovery of kimberlites in this large area.

Contact: Brian Atkinson
Tel: (705) 235-1619; Fax: (705) 235-1620
E-mail: brian.atkinson@ndm.gov.on.ca
Contact: Tom Morris
Tel: (705) 670-5968; Fax: (705) 670-5905
E-mail: tom.morris@ndm.gov.on.ca

# International suppliers of mining equipment and services



Ontario companies supply everything from contract mining to custom equipment design.

More than 300 Ontario companies supply mining equipment and services to hundreds of exploration and development projects in dozens of countries around the world. The province boasts top experts in technology, science, metallurgy and the environment. Their expertise makes Ontario a leader in a rapidly globalizing mining industry.

Ontario's mining service and supply companies provide analytical laboratories, environmental studies and mining contracting. They also offer support for mineral exploration including diamond drilling, geological and geophysical surveying, and geochemical sampling and surveying.

Ontario's mining services and supply sector produces about $1 billion of goods and services each year, half of which is exported. The sector has played a large part in the success of Ontario mining companies in international mineral exploration, development and sales.

Companies interested in mining services and supplies can contact the Canadian Association of Mining Equipment and Services for Export (CAMESE). This association has a strong Ontario membership. See page 24 for contact information.

# Contacts

## THE ONTARIO MINISTRY OF NORTHERN DEVELOPMENT AND MINES

Minister and Deputy Minister's Offices
Room 5630, Whitney Block
99 Wellesley Street West
Toronto, Ontario
M7A 1W3 Canada
Tel: (416) 327-0633
Fax: (416) 327-0665

Deputy Minister's Office in Thunder Bay
Ontario Government Building
435 James Street South, Suite 340
Thunder Bay, Ontario
P7E 6S8 Canada

Mines and Minerals Division
Willet Green Miller Centre
933 Ramsey Lake Road, 6th Floor
Sudbury, Ontario
P3E 6B5 Canada
Tel: (705) 670-5755
Fax: (705) 670-5807
Toll Free: 1-888-415-9845
Website: www.gov.on.ca/mndm

Assistant Deputy Minister's Office
Tel: (705) 670-5877
Fax: (705) 670-5818

Information Services
(Mines Library, statistics, marketing, land use planning coordination, publications, GEO Enterprises Ontario)
Tel: (705) 670-5838
Fax: (705) 670-5807

Mining Lands
(land tenure, claims staking, assessment work)
Tel: (705) 670-5841
Fax: (705) 670-5863
Provincial Recording Office: (705) 670-5742
Toll-free in North America: (Mining Lands products, mining claim inquiries, Mining Act assessment work) 1-888-415-9845

Mining Lands Consultants
Kirkland Lake: (705) 568-4521
Red Lake: (807) 727-3284
Sault Ste. Marie: (705) 945-6925
Thunder Bay: (807) 475-1311
Timmins: (705) 235-1600
Toronto: 1-888-415-9845

Mines Group
(mine development, approvals and compliance, financial assurance)
Tel: (705) 670-5787
Fax: (705) 670-5803

Mineral Development Consultants
Sudbury: (705) 670-5827
Timmins: (705) 235-1629
Kenora: (807) 468-2925
Thunder Bay: (807) 475-1746

Data Services
(Earth Resources and Land Information System (ERLIS))
Tel: (705) 670-5778
Fax: (705) 670-5754

Ontario Geological Survey
(Precambrian and sedimentary geoscience, geological mapping and consultants)
Tel: (705) 670-5758
Fax: (705) 670-5905

Resident Geologist Offices
Kenora: (807) 468-2813
Red Lake: (807) 727-3272
Sioux Lookout: (807) 737-2037
Thunder Bay: (807) 475-1331
Sault Ste. Marie: (705) 945-6931
Timmins: (705) 235-1615
Kirkland Lake: (705) 568-4516
Sudbury: (705) 670-5735
Tweed: (613) 478-3161
Toronto: (416) 314-3600

Publication Sales
933 Ramsey Lake Road
Sudbury, Ontario
P3E 6B5 Canada
Tel: (705) 670-5691
Fax: (705) 670-5770
Toll-free in North America: 1-888-415-9845

## ASSOCIATIONS

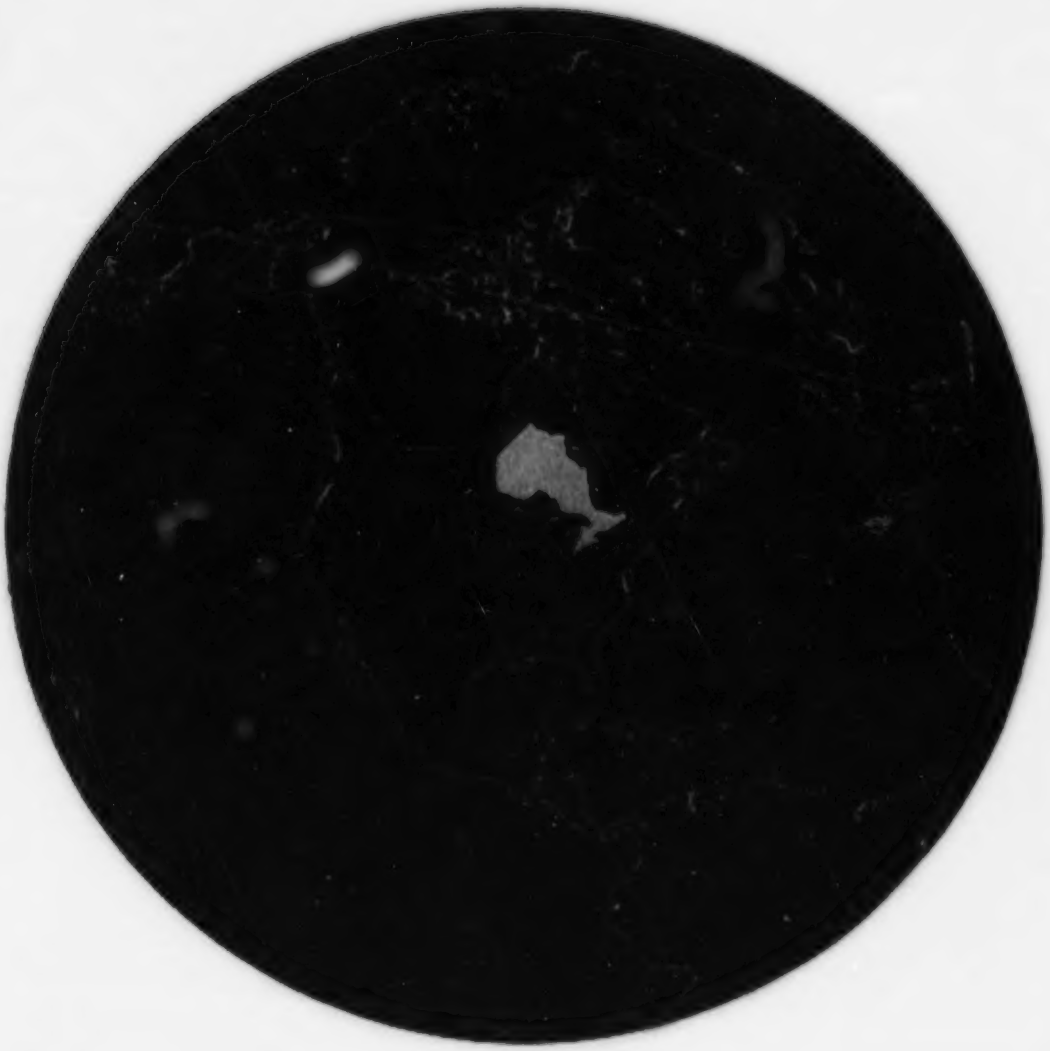
Canadian Association of Mining Equipment and Services for Export (CAMESE)
Suite 101, 345 Renfrew Drive
Markham, Ontario
L3R 9S9 Canada
Tel: (905) 513-0046
Fax: (905) 513-1834
Website: www.camese.org

Mining Association of Canada
1105 – 350 Sparks Street
Ottawa, Ontario
K1R 7S8 Canada
Tel: (613) 233-9391
Fax: (613) 233-8897
Website: www.mining.ca

Ontario Mining Association
110 Yonge Street, 15th Floor
Toronto, Ontario
M5C 1P4 Canada
Tel: (416) 364-9301
Fax: (416) 364-5986
Website: www.oma.on.ca

Prospectors & Developers Association of Canada
34 King Street East, 9th Floor
Toronto, Ontario
M5C 2X8 Canada
Tel: (416) 362-1969
Fax: (416) 362-0101
Website: www.pdac.ca

Ontario Prospectors Association
P.O. Box 1665
Timmins, Ontario
P4N 7W8 Canada
Tel: (807) 622-3284
Fax: (807) 622-4156
Website: www.members.tripod.com/opa1/



For more information about the opportunities awaiting your business in Ontario


Contact us at:
1-800-819-8701

e-mail: ontario@simcoe.cisc.on.ca

Ontario Investment Service
BCE Place
Canada Trust Tower, Suite 4040, 161 Bay Street
Toronto, Ontario, CANADA M5J 2S1
Tel: (416) 360-4647 Fax: (416) 360-1817

www.2ontario.com


Ontario